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Site Environmental Report for 2002

Sandia National Laboratories, California

B. L. Larsen

Prepared by
Sandia National Laboratories
Livermore, California 94550

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Barbara L. Larsen
Environmental Operations Department
Sandia National Laboratories, California

ABSTRACT

Sandia National Laboratories, California (SNL/CA) is a government-owned/contractor-operated laboratory. Sandia Corporation, a Lockheed Martin Company, operates the laboratory for the Department of Energy's (DOE) National Nuclear Security Administration. The DOE, Sandia Site Office oversees operations at the site, using Sandia Corporation as a management and operating contractor. This Site Environmental Report for 2002 was prepared in accordance with DOE Order 231.1. The report provides a summary of environmental monitoring information and compliance activities that occurred at SNL/CA during calendar year 2002. General site and environmental program information is also included.

Preface

Each year, Sandia National Laboratories, California (SNL/CA) prepares a summary report to provide environmental information to the local community, pursuant to the requirements of Department of Energy Order 231.1. The Site Environmental Report for 2002 summarizes SNL/CA's compliance with environmental requirements, presents the results of monitoring and surveillance activities, and provides an update of site environmental programs.

The Site Environmental Report for 2002 was prepared for ease in readability. Each chapter focuses on a specific topic or area. Reference to other sections and chapters is made throughout the report to avoid redundancy. Detailed data is provided only when necessary to improve the presentation of information and the quality of the document. Acronyms are defined within each chapter as well as listed at the beginning of the report. References are compiled into one list and presented at the end of the document.

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Acronyms and Abbreviations

ALARA	as low as reasonably achievable
BAAQMD	Bay Area Air Quality Management District
BTEX	benzene, toluene, ethylbenzene, and xylene
CCR	California Code of Regulations
CARB	California Air Resources Board
CEARP	Comprehensive Environmental Assessment and Response Program
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CPAP	contractor performance assessment program
DOE	Department of Energy
DOE/SSO	Department of Energy, Sandia Site Office
DTSC	Department of Toxic Substances Control (California)
EO	executive order
EPA	Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
ES&H	environment, safety and health
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FONSI	Finding of No Significant Impact
General Construction Permit	State of California, NPDES General Permit to Discharge Storm Water Associated with Construction Activity
General Permit	State of California, NPDES General Permit for Storm Water Discharge Associated with Industrial Activities
ISMS	integrated safety management system
kg	kilogram
LECS	liquid effluent control system
LLNL	Lawrence Livermore National Laboratory
MCLs	maximum contaminant levels

mg/L	milligrams per liter
mrem	millirem
mSv	milliSeivert
M&O	management and operating
NEPA	National Environmental Policy Act
NNSA	National Nuclear Security Administration
NPDES	national pollutant discharge elimination system
PCB	polychlorinated biphenyl
pCi/L	picocuries per liter
POTW	publicly owned treatment works
PPOA	pollution prevention opportunity assessment
PP/WM	Pollution Prevention and Waste Minimization
QAP	quality assurance program
QAPP	quality assurance program plan
RCRA	Resource Conservation and Recovery Act
RWQCB	Regional Water Quality Control Board (California)
SNL	Sandia National Laboratories
SNL/CA	Sandia National Laboratories, California
SNL/NM	Sandia National Laboratories, New Mexico
SWEA	Site-wide Environmental Assessment
SWMU	solid waste management unit
TPHD	total petroleum hydrocarbons diesel
TSCA	Toxic Substances Control Act
µg/L	micrograms per liter
USC	United States Code
USFWS	United States Fish and Wildlife Service
UST	underground storage tank

1 Executive Summary

1.1 Overview

Sandia National Laboratories is one of three national laboratories supporting the U.S. Department of Energy (DOE) statutory responsibilities for nuclear weapon research and design, development of energy technologies, and basic scientific research. Sandia has facilities in New Mexico, California, Nevada, and Hawaii. Sandia National Laboratories, California (SNL/CA) is a multi-program engineering and science laboratory supporting the nuclear weapons stockpile program, energy and environment research, homeland security, micro- and nano-technologies, and basic science and engineering research.

The Site Environmental Report provides a summary of environmental management performance and compliance efforts at SNL/CA for calendar year 2002. The document also satisfies the DOE requirement for preparation of an annual environmental report as listed in *DOE Order 231.1, Environment, Safety, and Health Reporting* (DOE 1996).

The Site Environmental Report is divided into ten chapters. Chapter 1, the Executive Summary, highlights compliance and monitoring results obtained in 2002. Chapter 2 provides a brief introduction to SNL/CA and the existing environment found onsite. Chapter 3 summarizes SNL/CA's compliance activities with the major environmental requirements applicable to site operations. Chapter 4 presents information on environmental management, performance measures, and environmental programs. Chapter 5 presents the results of monitoring and surveillance activities in 2002. Chapter 6 discusses quality assurance and Chapters 7 through 9 provide supporting information for the report and Chapter 10 is the report distribution list.

1.2 Performance Measures

SNL/CA's environmental performance is evaluated against corporate-wide performance measures established jointly by the DOE/Sandia Site Office (DOE/SSO) and Sandia Corporation. In Fiscal Year 2002 (October 1, 2001 through September 31, 2002), the following five corporate measures were applicable to SNL/CA: environmental compliance; integrated safety management system; preventing pollution and conserving resources; disposal of radioactive waste; and radiation protection and operations. Sandia's performance rating for these five measures consisted of four excellent ratings and one good rating. Although performance ratings reflect corporate-wide results, performance at SNL/CA contributed to the overall scores obtained. Additional information about performance measures is provided in Chapter 4.

1.3 Environmental Management

SNL/CA follows an integrated safety management system (ISMS) for environmental management. ISMS is enhanced with a corporate-wide environment, safety, and health (ES&H) policy and ES&H program manual that directs and guides environmental compliance activities. The entire Sandia workforce is responsible for implementing ISMS and incorporating ES&H policy and procedures into their work activities. ISMS includes five management functions that support work planning, hazard analysis, hazard control, work performance, and feedback and improvement. The ES&H policy mandates the requirement for environmental compliance. The ES&H manual assists the Sandia workforce in meeting compliance requirements. In 2002, no significant changes occurred in the environmental management system. However, Sandia Corporation is working to enhance the elements of ISMS to improve the environmental management framework at Sandia facilities.

1.4 Environmental Monitoring

SNL/CA monitors storm water, wastewater, groundwater, and direct (ambient) radiation. The results of monitoring show that no pollutants were detected in storm water runoff at levels that are a cause for concern and that all wastewater generated by site operations complied with the site outfall discharge limits for regulated physical parameters and most metals. The site exceeded the discharge limit for copper at the sewer outfall on one occasion in 2002. SNL/CA continued to see carbon tetrachloride in groundwater at the Navy Landfill well and diesel at the Fuel Oil Spill site in 2002, with concentrations similar to those detected in past years. The average annual external radiation dose at the site perimeter was 66.0 mrem (0.66 mSv), which is within the dose range measured over the last ten years. Monitoring data indicate that SNL/CA is not contributing significantly to the external radiation dose in the area. Additional information about environmental monitoring at SNL/CA is provided in Chapter 5.

2 Introduction

2.1 History and Mission

Sandia National Laboratories, California (SNL/CA) was established in 1956 by Sandia Corporation to provide a closer relationship with Lawrence Livermore National Laboratory (LLNL) and their nuclear weapons design work. The SNL/CA facility evolved into an engineering research and development laboratory by the early 1960s, and into a multi-program engineering and science laboratory during the 1970s. As international arms control efforts increased in the late 1970s and throughout the 1980s, the United States emphasized treaty monitoring, safety, security, and control of the national nuclear weapons stockpile. With the end of the Cold War in the late 1980s, the role of SNL/CA to support stockpile stewardship ensuring nonproliferation and continued safety, security, and reliability, took on greater importance.

SNL/CA is a national laboratory dedicated to enabling global peace through unmatched contributions to our nation's security. Our core mission is exceptional stewardship of the nation's nuclear deterrent through valued solutions offered by our science based engineering approach. The mission and approach are expanded by broader roles in national security emphasizing defense and nonproliferation of weapons of mass destruction, energy and information surety, and unique contributions to our nation's conventional military capabilities.

SNL/CA is a government owned/contractor operated laboratory. The site, the buildings, and the equipment are owned by the government; while Sandia Corporation, a Lockheed Martin Company, operates the laboratory for the Department of Energy's (DOE) National Nuclear Security Administration (NNSA). The DOE/Sandia Site Office (DOE/SSO) oversees the operations at the site, using Sandia Corporation as a management and operating (M&O) contractor.

Research activities at SNL/CA consist of the following:

- science-based performance and reliability testing and computer-based modeling of nuclear weapon components;
- development, design, and testing of nonnuclear components for nuclear weapon systems;
- development and testing of materials and diagnostic equipment in support of defense programs, homeland security, and basic science and engineering;
- energy and environmental research; and
- research and development of microelectronics, microsystems, and nanotechnologies.

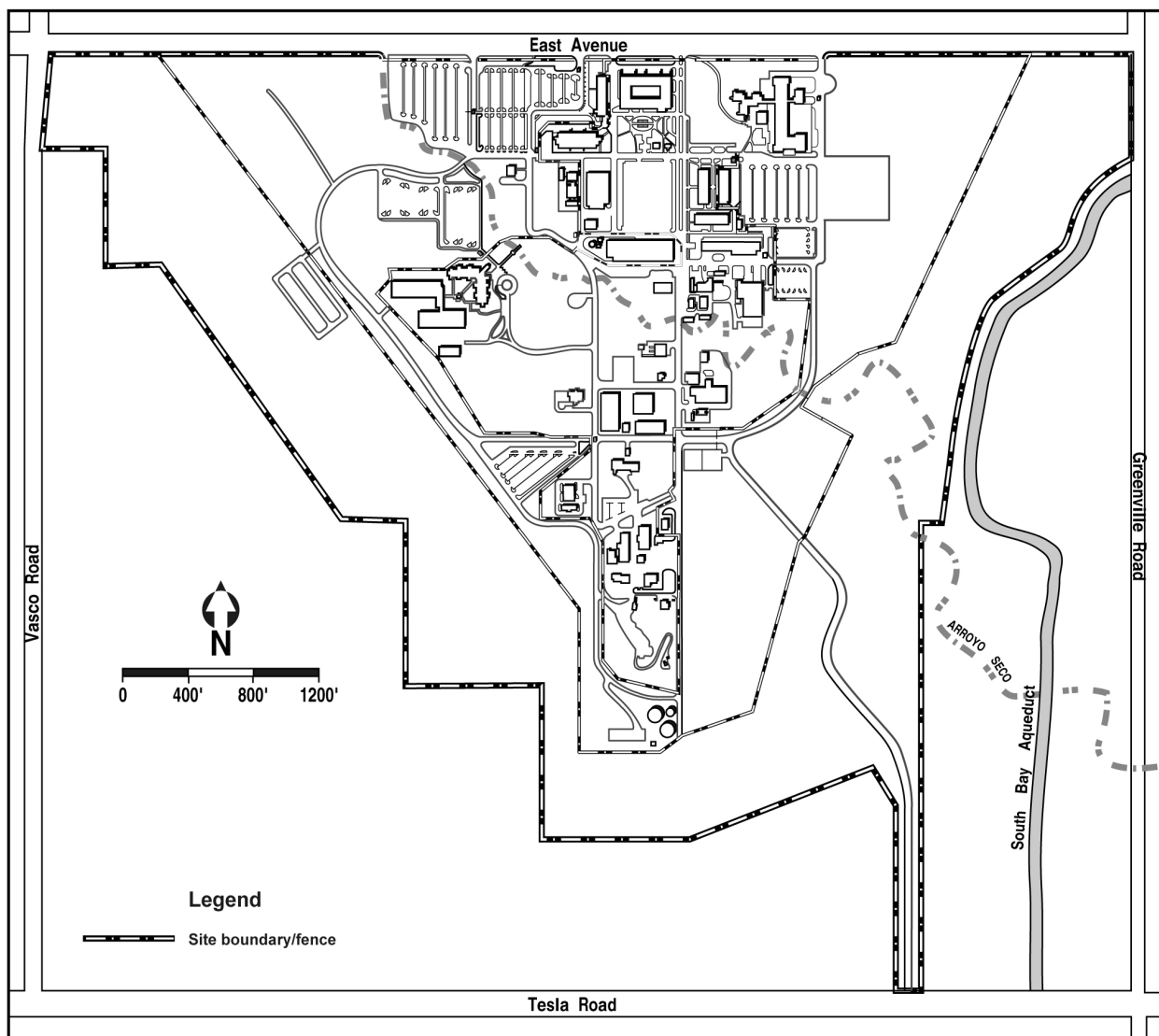


Figure 2-2 SNL/CA Site Map

2.3 Site Population

The SNL/CA workforce is comprised of Sandia employees (full and part-time staff, student interns, and post-doctoral appointees) and contractor staff. In September 2002, there were 1067 Sandia employees working at SNL/CA. This represents a slight decrease from 2001, when Sandia employment was 1085. Eighty-eight percent of Sandia employees live in Alameda, Contra Costa, and San Joaquin counties. Thirty-eight percent live in Livermore. The contractor workforce fluctuates throughout the year depending on program staffing needs. An estimate of contractor staff is not available.

2.4 Environmental Setting

The following summarizes the environmental setting at SNL/CA. Additional information can be found in the *Final Site-wide Environmental Assessment of the Sandia National Laboratories/California* (DOE 2003a).

2.4.1 Geology and Soils

SNL/CA is located in the California Coast Ranges geologic province in the southeastern portion of the Livermore Valley. The valley forms an irregularly shaped lowland area about 16 miles long, east to west, and 7 to 10 miles wide, north to south. The land at SNL/CA slopes gently to the northwest and north, with steep terrain in the southern portion of the site and along the banks of Arroyo Seco. The site ranges in elevation from 849 feet above mean sea level at the southern end to 615 feet at the northwest corner of the property. Site topography is depicted on Figure 2-3.

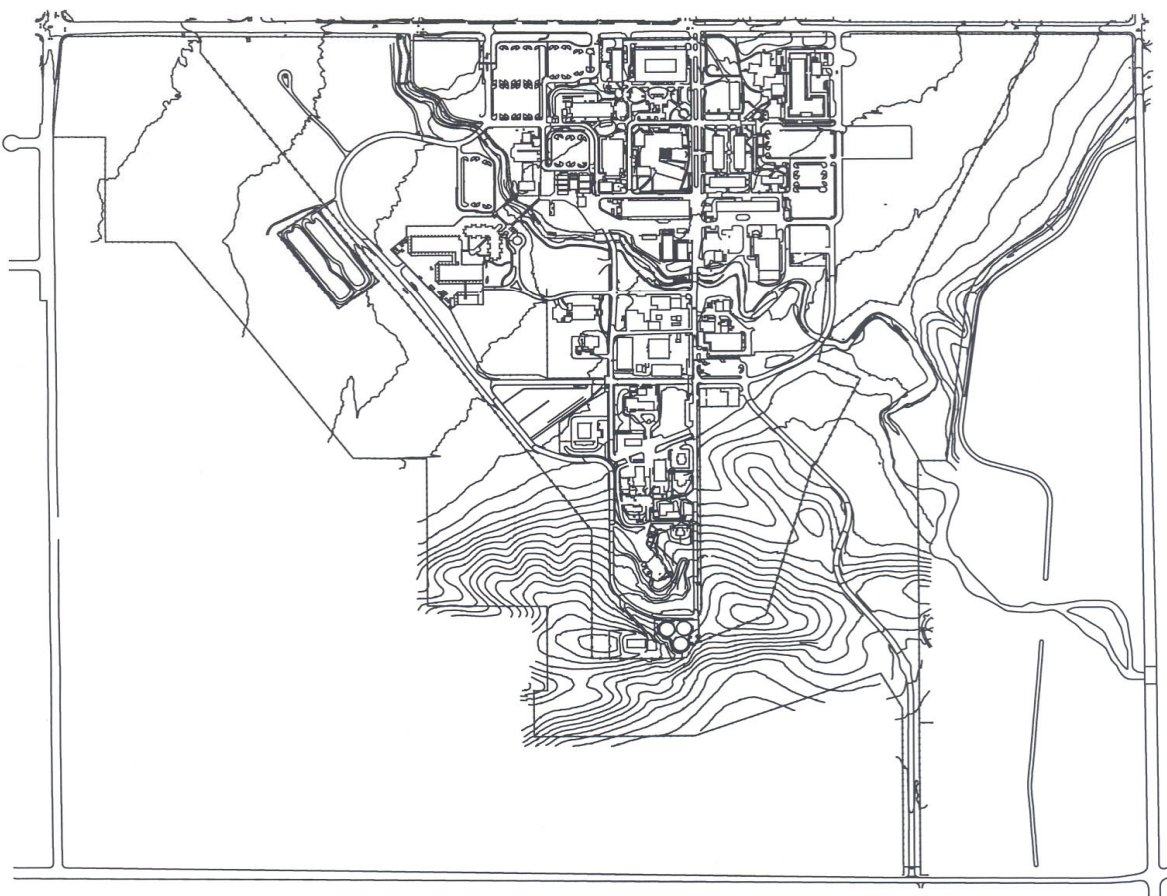


Figure 2-3 SNL/CA Topography

SNL/CA is located in a seismically active region. The major fault systems in the area are the San Andreas Fault system and the much older Coast Range thrust fault system. The upper plate of the Coast Range thrust formed the northwest trending Coast Range, including the Altamont Hills. Any seismic activity in the Livermore Valley would probably result from movement on the San Andreas Fault, a right-lateral strike-slip fault system trending northwest-southeast, extending from Point Arena to the Gulf of California. The regional faults closest to SNL/CA, the Hayward, Calaveras, Greenville, and Tesla faults follow this trend, and have been seismically active in the historic past. The Las Positas fault crossing SNL/CA is a transverse fault, at right angles to the Greenville fault, and is also active. Regional faults are shown on Figure 2-4.

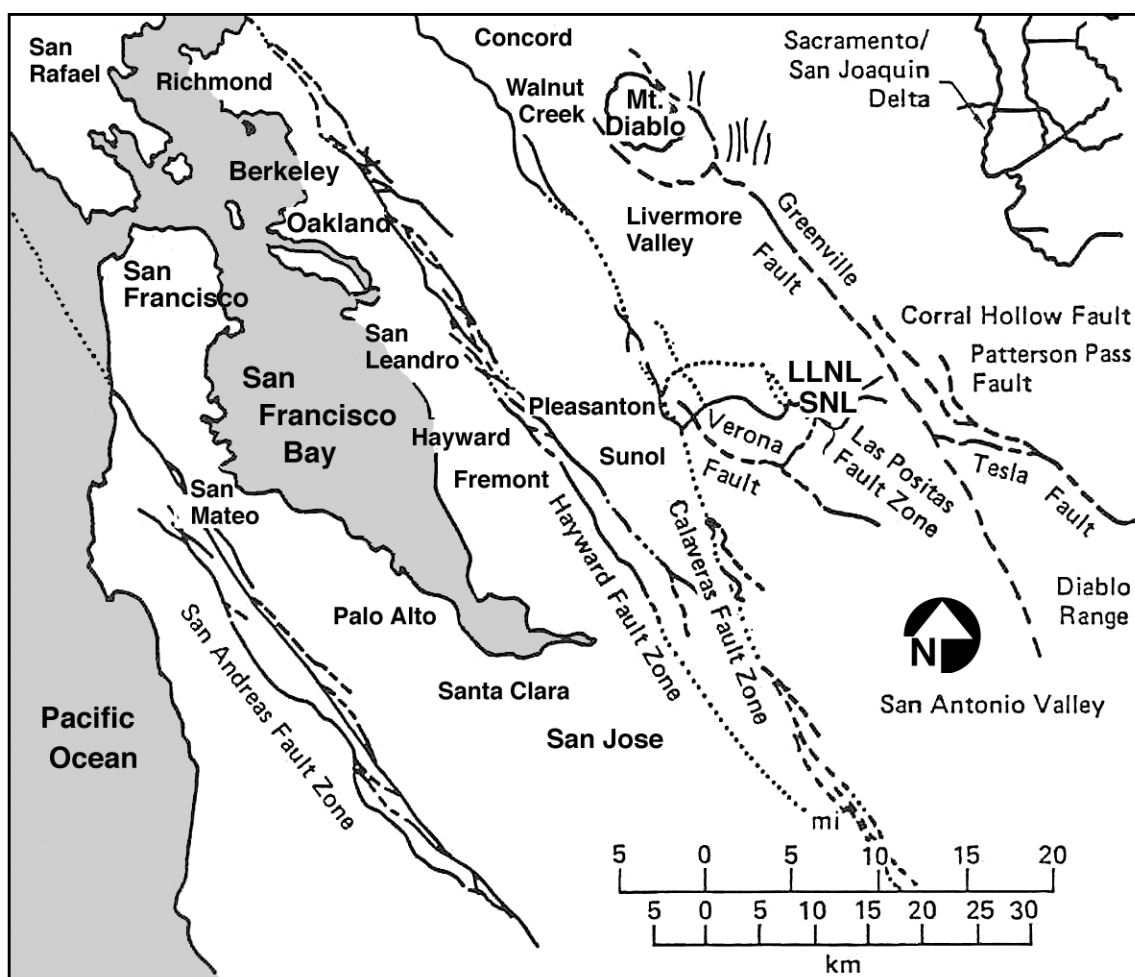


Figure 2-4 Regional Earthquake Faults

Surface soils and arroyo sediments cover the SNL/CA site. Underlying soils at the site are formed primarily upon sediments deposited by local streams. Three soils cover most of

SNL/CA: Rincon clay loam, Positas gravelly loam, and Livermore gravelly loam. There are no known mineral resources or fossil occurrences at the site.

2.4.2 Hydrology and Water Resources

Groundwater in the SNL/CA area occurs within saturated unconsolidated geologic material. Depth to groundwater varies from approximately 80 feet in the northwest corner of the site to 126 feet on the east side of the site. Water bearing-units beneath the site are composed of shallow heterogeneous, unconsolidated alluvium and deep fluvial and lacustrine sediments. Groundwater near SNL/CA is generally suitable for use as domestic, municipal, agricultural, and industrial supply. However, some shallower groundwater may be of marginal quality and not suitable for industrial or agricultural purposes. Groundwater less than 300 feet deep is usually unsuitable for domestic use without treatment.

SNL/CA purchases potable water from LLNL, who is supplied by the San Francisco Water District through the Hetch Hetchy Aqueduct. Additionally, the Alameda County Flood Control and Water Conservation District, Zone 7, supplements this primary water source as needed. SNL/CA's water use is not separately metered but is estimated to be 20 percent of LLNL's water use. In 2002, SNL/CA used an estimated 113.4 million gallons of water and discharged approximately 8.03 million gallons of wastewater. Water losses include irrigation, cooling towers, water tank releases, evaporative losses, eyewash and safety shower testing, fire system testing, and wash water from liquid effluent control system tanks that is trucked offsite for disposal.

There are no perennial streams or natural surface water bodies at SNL/CA. The Arroyo Seco, an ephemeral and intermittent stream, diagonally traverses the site from southeast to northwest. The creek typically flows only in very wet years, and for short periods of time during heavy storms. A seasonal wetland that is wet well into June, and sometimes July, is located in the creek bed along the eastern part of the arroyo. Storm water runoff at SNL/CA is conveyed to Arroyo Seco through a system of storm drains and channels. The Arroyo Seco and seasonal wetland are shown on Figure 2-5.

Two manmade ponds, encompassing approximately 2.7 acres, are located in the west buffer at SNL/CA. These ponds were constructed by LLNL in 1989 and serve as a recharge basin for their groundwater treatment program. Treated water from the LLNL site is discharged to the ponds and percolates throughout the underlying unsaturated sediments and eventually recharges the two shallowest local groundwater units (SNL 2002a). The ponds and resulting open water habitat are maintained and managed by LLNL.

2.4.3 Climate and Meteorology

The climate at SNL/CA is typical of the Mediterranean conditions in the San Francisco Bay region where cool, wet winters and hot, dry summers are normal. In the summer, inland valleys, such as the Livermore Valley, generally experience more sunshine and higher temperatures than the coastal areas. In the winter, temperatures in the valley are usually cooler than at the coast.

Meteorological data for the SNL/CA area is obtained from two meteorological towers, one located onsite and the other located approximately one mile north at LLNL. The average annual rainfall near SNL/CA over the last seven years was 12.6 inches. The annual rainfall for 2002 was 10.6 inches. Hourly temperatures in 2002 ranged from 28° to 105° Fahrenheit. The windiest months in the area occur in the spring and summer, and are dominated by westerly sea breezes. The winds during the fall and winter are typically lighter and more varied in direction.

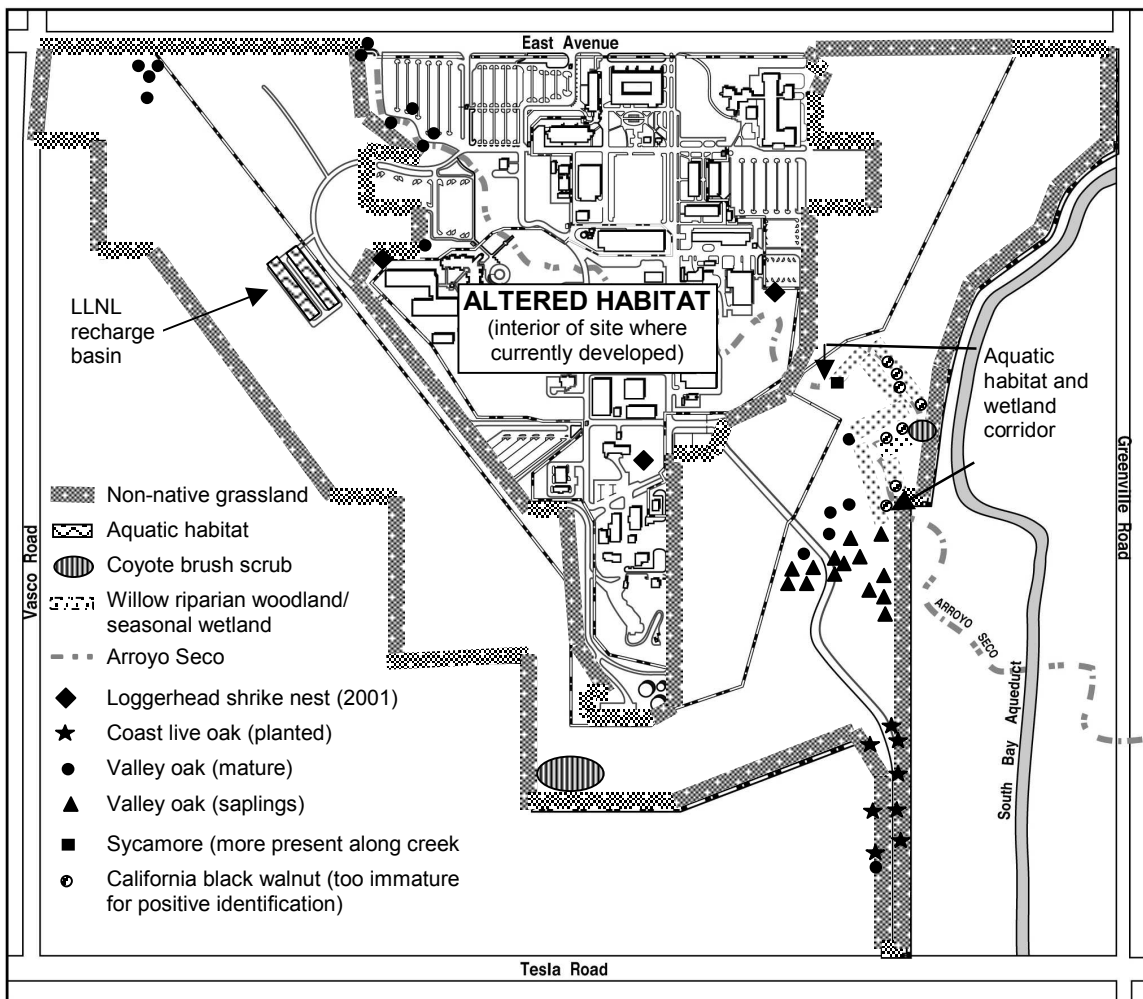


Figure 2-5 Wildlife and Habitat at SNL/CA

2.4.4 Ecology

The plant community at SNL/CA is typical of the surrounding region, consisting primarily of grassland. Localized areas of coyote brush scrub, willow riparian woodland, and aquatic habitat are also present. Areas developed and disturbed by Sandia operations constitute an

additional habitat type, designated altered habitat. Habitat types are depicted on Figure 2-5. No threatened, endangered, proposed, or candidate plant species are present onsite.

A variety of wildlife species live and forage at SNL/CA. Since 1994, more than fifty bird species, five species of amphibians and reptiles, and fourteen mammal species have been observed onsite. No threatened, endangered, or proposed wildlife species are present onsite. One candidate wildlife species, the California tiger salamander (*Ambystoma californiense*) is known to occur at SNL/CA. The most recent sighting of a tiger salamander was on January 6, 2003, when one individual was found in a shallow depression filled with leaf litter. Suitable aquatic habitat located at SNL/CA was surveyed for California tiger salamanders in 2001 and 2002. No larvae or adult salamanders were found during these surveys.

Most of the bird species found onsite are protected under the Migratory Bird Treaty Act. Several of these are also special concern species. The golden eagle (*Aquila chrysaetos*), ferruginous hawk (*Buteo regalis*), Cooper's hawk (*Accipiter cooperii*), and northern harrier (*Circus cyaneus*) are California species of special concern. The white-tailed kite (*Elanus leucurus*) is a California fully protected species. The loggerhead shrike (*Lanius ludovicianus*) and burrowing owl (*Athene cunicularia*) are both federal and California species of special concern. Of these special concern species, the loggerhead shrike is the only one known to be nesting at SNL/CA. The others are believed to be foraging onsite but not nesting.

SNL/CA is within the range of the California red-legged frog (*Rana aurora draytonii*), a threatened species under the *Endangered Species Act*. In surveys conducted at SNL/CA since 1997, no red-legged frogs have been found onsite. On March 13, 2001, the U.S. Fish and Wildlife Service (USFWS) designated critical habitat for the red-legged frog and included a portion of the Sandia site in Unit 15 (USFWS 2001). On November 6, 2002, the U.S. District Court issued a final ruling overturning the critical habitat designation for the California red-legged frog (US District Court 2002). The ruling approves a settlement between the U.S. Fish and Wildlife Service and the Home Builders Association of Northern California that eliminates all but 200,000 acres of the original four million acres designated. Areas within Alameda County, including the Sandia site, are not currently identified as critical habitat.

3 Compliance Summary

Sandia National Laboratories, California (SNL/CA) operates in compliance with the letter and spirit of applicable federal, state, and local environmental statutes and regulations. Additionally, as a Department of Energy (DOE) facility, the site is subject to DOE directives (DOE orders), and to presidential executive orders. This chapter provides a summary of SNL/CA compliance with major environmental requirements for the calendar year 2002.

3.1 DOE Order 5400.1

DOE Order 5400.1, General Environmental Protection Program, the active order for 2002, outlines the basic requirements for environmental compliance at DOE facilities including SNL/CA. On January 15, 2003, DOE Order 450.1 was issued, which will supersede and cancel DOE Order 5400.1 when incorporated into the Sandia management and operating contract. Incorporation of Order 450.1 into the Sandia management and operating contract is pending.

Order 5400.1 establishes mandatory environmental protection standards for DOE operations and states DOE policy: to conduct the Department's operations in compliance with the letter and spirit of applicable environmental statutes, regulations, and standards (DOE 1990). Sandia National Laboratories established a corporate environment, safety, and health (ES&H) policy that expresses the sites ES&H values, principles, and objectives. It prescribes boundaries within which Sandia conducts operations and it designates accountability for ES&H concerns and conduct to all employees. Additional information on the ES&H policy and environmental management system is provided in Chapter 4.

3.2 National Environmental Policy Act

The National Environmental Policy Act (NEPA) is the basic national charter for protection of the environment. It requires all federal agencies to evaluate the affects of major federal actions on the human environment, including the physical, socioeconomic, and cultural environments. NEPA review of DOE actions is conducted in accordance with *DOE NEPA Implementing Procedures* (10 CFR 1021). Under these procedures, DOE may prepare a programmatic (including site-wide) document at any time to further the purposes of NEPA. In 2002, the DOE/Sandia Site Office (DOE/SSO) prepared a site-wide environmental assessment (SWEA) for continued operations at Sandia National Laboratories, California (DOE 2003a) and issued a Finding of No Significant Impact (FONSI) on March 20, 2003 (DOE 2003b). The SWEA evaluates the impacts of site operations over the next ten years, and the FONSI concludes that continuation of site operations is not a major federal action significantly affecting the quality of the human environment.

SNL/CA supports compliance with NEPA and DOE's NEPA Implementing Procedures by reviewing all new projects and programs or changes to existing projects and programs to ensure that they fit within the bounds of existing NEPA documents and impact analyses for the site. The SNL/CA NEPA review process is documented in an administrative procedure. The procedure is reviewed and updated every three years, or as needed. NEPA data for 2002 are provided in Section 4.3.1, Environmental Program Highlights.

3.3 Air Quality

3.3.1 Clean Air Act

The Clean Air Act (42 USC § 7401) is the federal statute that forms the basis for the national air pollution control effort. It authorizes the Environmental Protection Agency (EPA) to promulgate air quality regulations and establishes national ambient air quality standards for criteria pollutants. Authority to implement the requirements of the Clean Air Act is provided to each state that has an EPA approved State Implementation Plan. The State Implementation Plan for California describes how National Ambient Air Quality Standards will be obtained in each air district. Each district establishes and enforces air pollution regulations to attain and maintain state and federal ambient air quality standards. The Bay Area Air Quality Management District (BAAQMD) is the regulating authority for controlling air pollution from stationary sources at SNL/CA. The California Air Resources Board (CARB) is responsible for ensuring that federal and state standards are met for mobile and small "area" sources of air pollution.

SNL/CA works with the BAAQMD and CARB to permit all regulated emission sources. In 2002, SNL/CA had 24 permitted emission sources (see Table 3-5, Section 3.14). Criteria pollutant and toxic air contaminant emissions from site operations are presented in Section 4.3.1, Table 4-2 and Table 4-3, respectively. The 2002 San Francisco Bay Area Air Basin emission inventory is not yet available for comparison. However, a comparison of 2001 site data to district data shows that site emissions are a small percentage of the total emissions in the air basin. Site emissions for 2002 are also expected to be a small percentage of total emissions in the air basin.

3.3.2 Radionuclide Emissions

The *National Emissions Standards for Hazardous Air Pollutants, Subpart H – National Emission Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities* (40 CFR Part 61) establishes radiation protection standards, monitoring requirements, and annual reporting of radionuclide air emissions. Additional requirements pertaining to radionuclide emissions are contained in *DOE Order 5400.1, General Environmental Protection Program* (DOE 1990), and *DOE Order 5400.5, Radiation Protection of the Public and the Environment* (DOE 1993).

SNL/CA does not currently have any radionuclide emission sources that are subject to the monitoring and reporting requirements of 40 CFR Part 61. To comply with national emission

standards, SNL/CA evaluates individual projects with the potential to release radionuclide emissions to determine the worst-case dose to the public. Additionally, dose calculations are compared to the requirements to determine the need for annual monitoring and reporting. During 2002, there were no projects with the potential to release radionuclides to the atmosphere and thus no project evaluations were completed.

3.4 Natural and Cultural Resources

3.4.1 Endangered Species Act

The Endangered Species Act (16 USC § 1531 et. seq.) provides for protection of plant and wildlife species in danger of becoming extinct. In 2002, SNL/CA and DOE/SSO prepared the *Biological Assessment for Continued Operation of Sandia National Laboratories, California* (DOE 2002b). The biological assessment was submitted to the U.S. Fish and Wildlife Service (USFWS) on July 19, 2002. The document assesses possible effects that increased operations at the site would have on the threatened California red-legged frog (*Rana aurora draytonii*), designated critical habitat for the red-legged frog¹, and the California tiger salamander (*Ambystoma californiense*), a candidate species. It concludes that increased operations *May Affect*, but would *Not Likely Adversely Affect* the California red-legged frog and its designated critical habitat and would not adversely affect the California tiger salamander. A biological opinion from the USFWS is pending.

3.4.2 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (16 USC § 703 et. seq.) provides for protection of migratory birds, their nests, and eggs. Fifty-four species of migratory birds have been observed at SNL/CA since 1994. In 2002, there was no intentional take of migratory birds at the site. Migratory birds often build nests within the developed campus in locations where they will be disturbed by maintenance activities. To avoid harming birds, nests, or eggs, SNL/CA follows a best management practice to delay activities until the young have fledged, or surveys determine that the nest is abandoned. In 2002, there were two occasions when activities were delayed to protect migratory birds.

3.4.3 Floodplain Management

Executive Order 11988, Floodplain Management (EO 11988), requires federal agencies to consider impacts associated with the occupancy and modification of floodplains, to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare,

¹ On November 6, 2002, the U.S. District Court issued a final ruling overturning the critical habitat designation for the California red-legged frog. The ruling approves a settlement between the U.S. Fish and Wildlife Service and the Home Builders Association of Northern California that eliminates all but 200,000 acres of the original four million acres designated. Areas within Alameda County, including the Sandia site, are not currently identified as critical habitat.

and to restore and preserve the natural and beneficial values served by floodplains. In 2002, SNL/CA completed a management plan for the Arroyo Seco to identify channel improvements and stream zone management activities that will reduce flood and erosion risk and provide improved habitat for wildlife species that may use the arroyo (Matthews 2002). The plan identifies areas for constructing functional floodplains and for planting of native riparian vegetation. Implementation of the management plan is scheduled to begin in 2004.

3.4.4 Protection of Wetlands

Executive Order 11990, Protection of Wetlands (EO 11990), requires federal agencies to minimize the destruction, loss, or degradation of wetlands and preserve and enhance the natural and beneficial values of wetlands. In 1999, a portion of the wetland located in the streambed of Arroyo Seco on the eastern side of the SNL/CA site was disturbed from removal of sediment build-up in the channel. A wetland restoration plan was prepared that established a goal of 60 percent re-vegetation with native wetland plants and growth of three willow cuttings within three years (SAIC 1999). The wetland area was replanted in December 1999. As of December 2002, the goals established in the restoration plan had been met.

3.4.5 National Historic Preservation Act

The National Historic Preservation Act (16 USC § 470) requires federal agencies to identify, record, and protect cultural resources. In 1990, an assessment of cultural resources at the SNL/CA site was completed. Although no prehistoric resources, Native American resources, or historic archaeological sites were identified during this assessment, there is a possibility that buried resources could be present onsite (DOE 2003a). SNL/CA includes provisions for cultural resources in all construction-related contracts where the potential for buried resources may be unearthed. In 2002, there were no buried archaeological resources unearthed at SNL/CA.

In 2001, SNL/CA completed an historic building survey. None of the buildings onsite were identified as historically significant or eligible for the National Register of Historic Places (SNL 2002d). The results of the historic building survey were submitted to DOE/SSO. DOE will consult with the State Historic Preservation Officer, as needed.

3.5 Environmental Restoration

3.5.1 Comprehensive Environmental Response, Compensation, and Liability Act

Between 1984 and 1986, DOE investigated the SNL/CA site under their Comprehensive Environmental Assessment and Response Program (CEARP) to identify and assess potential environmental problems (DOE 1986). The CEARP investigation evaluated compliance with major federal environmental laws, including the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 USC § 9601). CERCLA established

liability compensation, cleanup, and emergency response for hazardous substances released to the environment. During the CEARP investigation, two potential CERCLA sites were identified at SNL/CA, the Fuel Oil Spill Site and the Navy Landfill. A Hazard Ranking System study was performed for each site to determine if either qualified for listing on the National Priorities List. Hazard Ranking System scores for both sites fell below 28.5, the qualifying score for listing. Since completion of the CEARP investigation, there have been no hazardous substance releases or contaminated sites found at SNL/CA that warranted CERCLA investigation or a Hazard Ranking System study.

In addition to cleanup and emergency response requirements, CERCLA also established a program to report spills of hazardous substances to the National Response Center. SNL/CA incorporates CERCLA reporting requirements into an operating procedure for spill prevention and control (SNL/CA 2000). In 2002, there were no releases of hazardous substances that required notification under CERCLA.

3.5.2 Site Cleanup Orders

Since 1985, environmental restoration and monitoring activities at SNL/CA have been conducted in compliance with site clean-up orders issued by the California Regional Water Quality Control Board, San Francisco Bay Region under provisions established in the California Water Code (California RWQCB 1989). Although there are no active remediation sites at SNL/CA, groundwater monitoring is ongoing at three locations, the Fuel Oil Spill site, the Navy Landfill, and the former Trudell Auto Repair Shop. With approval from the Regional Board, SNL/CA closed four monitoring wells at the Fuel Oil Spill site in 2002. SNL/CA currently samples four groundwater monitoring wells for residual contamination, two at the Fuel Oil Spill site, and one each at the Navy Landfill and Trudell site. Sampling results are presented in Chapter 5, Environmental Monitoring.

3.6 Hazardous Materials

3.6.1 Emergency Planning and Community Right-to-Know Act

The Emergency Planning and Community Right-to-Know Act (EPCRA)—also known as the Superfund Amendments and Reauthorization Act of 1986, Title III (42 USC §11001, et. seq.)—requires reporting of toxic chemical usage and releases. To meet EPCRA requirements, SNL/CA submits annual reports to the EPA, the State of California, and the LLNL Fire Department, which serves as the local fire department. EPCRA reporting requirements applicable to SNL/CA for 2002 are presented in Table 3-1.

3.6.2 California Hazardous Materials Release Response Plans and Inventory Law

The California Hazardous Materials Release Response Plans and Inventory Law (Assembly Bill 2185) addresses the management of hazardous and acutely hazardous materials in the state. Additional requirements pertaining to hazardous materials are codified in the California

Health and Safety Code, Division 20, Chapter 6.95 §25500, et seq. In compliance with California requirements, SNL/CA annually submits a hazardous material business plan to the Alameda County Office of Environmental Health.

Table 3-1 Status of EPCRA Reporting at SNL/CA, 2002

EPCRA Section	Description of Reporting	Required in 2002
Sec. 302-303	Planning Notification	No
Sec. 304	Extremely Hazardous Substances Release Notification	No
Sec. 311-312	Material Safety Data Sheet/ Chemical Inventory	Yes
Sec. 313	Toxic Release Inventory Reporting	Yes

3.6.3 Underground Storage Tanks

Hazardous or petroleum products stored in underground storage tanks (UST) are regulated under California Health and Safety Code Division 20, Chapter 6.67, §§ 25280-25299.7. California code incorporates the UST provisions of the Resource Conservation and Recovery Act (RCRA) and establishes standards for construction, operation, maintenance, inspection, and testing of USTs. Alameda County Environmental Health Department is the regulating authority for USTs at SNL/CA. SNL/CA operates one UST in accordance with California requirements. Each year, SNL/CA declares and permits the tank with the Alameda County Office of Environmental Health.

3.6.4 Toxic Substances Control Act

The Toxic Substances Control Act (TSCA) is the primary Federal statute regulating the manufacture, use, distribution, disposal, import, or export of certain chemicals and substances (15 USC § 2601 et. seq.). TSCA requirements that are applicable to Sandia operations are incorporated into the Sandia ES&H Manual (SNL 1997). SNL/CA follows the procedures outlined in the ES&H Manual for import and export of chemical substances. In 2002, one TSCA regulated chemical was imported onsite. There were no exports of TSCA regulated chemicals from the site in 2002.

SNL/CA also tracks disposal of TSCA materials that are not otherwise captured as RCRA or California toxic hazardous waste. These materials include asbestos and polychlorinated biphenyls (PCBs). The majority of TSCA waste generated onsite is asbestos from abatement activities. Only small quantities of PCB wastes are generated at SNL/CA, consisting of light ballasts that are not specifically marked as PCB-free.

3.6.5 Federal Insecticide, Fungicide, and Rodenticide Act

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) restricts the registration, sale, use, and disposal of pesticides (includes herbicides, insecticides, fungicides, and rodenticides) (7 USC § 136). Activities at SNL/CA that fall under the provisions of FIFRA include the storage and use of pesticides and disposal of pesticide containers. Pesticide

handling and storage follows a site-specific standard operating procedure that includes provisions for training, use of personal protective equipment, proper handling following manufacturers guidelines, secondary containment during storage, and disposal of product and containers (SNL/CA 2001). Pesticide use at SNL/CA is overseen by a certified pesticide applicator.

3.7 Pollution Prevention and Waste Minimization

3.7.1 Executive Order 13101

Executive Order 13101, Greening the Government Through Waste Prevention, Recycling, and Federal Acquisition (EO 13101) directs executive agencies to implement affirmative procurement programs that favor acquisition and use of recycled products and environmentally preferable products and services. EO 13101 also establishes an annual reporting requirement for federal agencies.

At SNL/CA, affirmative procurement is a coordinated effort between the Pollution Prevention and Waste Minimization (PP/WM) Program and the Procurement Department. PP/WM staff communicate the requirements of EO 13101 through presentations and training targeting individuals involved in purchasing products and services. Both groups work closely with suppliers to ensure that environmentally preferable products are available for purchase.

In 1996, DOE established a goal for purchases of EPA designated recycled products of 100 percent by 2005, except where products are not commercially available competitively at a reasonable price, or do not meet performance standards. Of the products purchased by SNL/CA in 2002, 40.3 percent contained recycled materials. Affirmative procurement information for SNL/CA was submitted to DOE in December 2002 in the annual *Environmentally Preferable Products Report*.

3.7.2 Hazardous Waste Source Reduction and Management Review Act

The California Hazardous Waste Source Reduction and Management Review Act of 1989, (Senate Bill 14), requires hazardous waste generators to consider source reduction as the preferred method of managing hazardous waste. Under this act, facilities that generate more than 12,000 kilograms (kg) of hazardous waste or 12 kg of extremely hazardous waste annually are required to conduct source reduction planning.

Under this Act, DOE's California sites together are considered one waste generator rather than each individual DOE facility. Every four years, SNL/CA participates in completing a Source Reduction and Evaluation Review and Plan with the three other DOE sites in California: LLNL; Lawrence Berkeley National Laboratory; and Stanford Linear Accelerator Center. The most recent report was completed in 1999 and provides information for 1994 through 1998. The next report is scheduled for completion in 2003 and will present data for the period from 1999 through 2002.

3.7.3 *Pollution Prevention Act*

The Pollution Prevention Act of 1990 declares, as national policy, that pollution should be prevented or reduced at the source (42 USC § 13101 et. seq.). Facilities that meet the reporting requirements under EPCRA, Section 313 are also required to file a toxic chemical source reduction and recycling report. The Section 313 report for 2002 will include source reduction and recycling information to meet this requirement. See Section 3.6.1 for additional information on EPCRA.

3.8 Hazardous Waste Management

3.8.1 *Federal Facility Compliance Act*

The Federal Facility Compliance Act waives sovereign immunity with respect to RCRA for federal facilities (42 USC § 6961). The act gives EPA and authorized states authority to conduct annual inspections of federal facilities and establishes requirements for management of mixed waste.

SNL/CA is not subject to a site-specific federal facility compliance agreement for mixed waste. The site does not possess or store any legacy mixed waste. All mixed waste generated at SNL/CA during 2002 was appropriately managed under the site's RCRA Hazardous Waste Facility Permit.

3.8.2 *Resource Conservation and Recovery Act*

RCRA regulates the generation, transportation, treatment, storage, and disposal of hazardous chemical waste, non-hazardous solid waste, and hazardous or petroleum products stored in USTs (42 USC §6901 et. seq.). The State of California has authority from the EPA to implement RCRA. The California Department of Toxic Substance Control (DTSC) administers most aspects of RCRA in the state and is the regulating authority for hazardous waste management at SNL/CA, including the hazardous component of radioactive mixed waste.

SNL/CA operates a Hazardous Waste Storage Facility under a RCRA Hazardous Waste Facility Permit that was issued by DTSC in 1992. The permit became effective on January 4, 1993, and allows for storage and treatment of hazardous waste. An application for the renewal of SNL/CA's RCRA Hazardous Waste Facility Permit was submitted to DTSC in December 2001. DTSC is currently reviewing the application. SNL/CA expects to receive DTSC approval and the permit renewal in 2003.

By definition, SNL/CA is a large quantity generator of RCRA waste. As such, the site is required under RCRA standards and implementing regulations (40 CFR 262.41) to submit a biennial report to EPA. The biennial report was submitted in March 2002 and provides information about the quantity of RCRA hazardous waste generated, stored, and shipped during the 2001 reporting period.

Also in 2002, SNL/CA closed a solid waste management unit following RCRA and DTSC requirements. Closure activities are presented under the waste management program in Section 4.3.1, Environmental Program Highlights.

3.8.3 California Hazardous Waste Control Law

The Hazardous Waste Control Law (California Health and Safety Code §25100 et. seq.) provides a separate regulatory framework for hazardous waste management in California. The state law incorporates all RCRA requirements and imposes additional requirements that are stricter than RCRA standards. Under the California law, additional waste materials are regulated as hazardous that are not considered hazardous under RCRA. State standards are incorporated into SNL/CA's Waste Management Program so that California regulated waste is managed as hazardous waste in compliance with state requirements.

The California Environmental Health Standard for Management of Hazardous Waste (22 CCR, Division 4.5) requires all permitted hazardous waste facilities to submit an annual facility report to DTSC. Annual facility reports provide information about the quantity of RCRA and California designated hazardous waste generated and stored at SNL/CA, and the quantity of waste shipped from the site. In March 2002, the Annual Facility Report for the SNL/CA Hazardous Waste Storage Facility was submitted to DTSC.

3.8.4 Medical Waste Management Act

The California Medical Waste Management Act (California Health and Safety Code, Division 104, Part 14, §§ 117600-118360) provides for regulation of medical waste generators, transporters, and treatment facilities. The California Department of Health Services is the regulating authority for medical waste in the state. As a generator of medical waste, SNL/CA is subject to the requirements of the Medical Waste Management Act. To meet these requirements, SNL/CA is in the process of registering as a small quantity generator. The registration process is scheduled for completion in 2003.

3.9 Radiation Protection

3.9.1 Atomic Energy Act

The purpose of the Atomic Energy Act is to assure the proper management of nuclear materials and radioactive waste (42 USC § 2011 et. seq.). The act allows DOE to set radiation protection standards to control exposure to the public and the environment that may result from operations at DOE facilities. DOE sets these standards through department directives or orders. Operations at SNL/CA are subject to the requirements established in *DOE Order 435.1, Radioactive Waste Management* (DOE 2001) and *DOE Order 5400.5, Radiation Protection of the Public and the Environment* (DOE 1993).

3.9.2 DOE Order 435.1, Radioactive Waste Management

DOE Order 435.1 establishes requirements to manage radioactive waste in a manner that protects the environment, and worker and public health and safety. Under this order, DOE contractor operated facilities are required to plan, document, execute, and evaluate the management of radioactive waste. Required elements of Order 435.1 are incorporated into the SNL/CA radioactive waste management program. The program includes certification and characterization of waste; provisions for inspections and audits; training requirements; and operating procedures for handling, storing, packaging, shipping, and offsite disposal of waste.

SNL/CA generates low-level radioactive waste and low-level mixed waste. No transuranic or high-level radioactive waste is generated by SNL/CA operations. Radioactive wastes are stored onsite in the Radioactive Waste Storage Facility. Low-level waste is shipped offsite for land disposal at the Nevada Test Site. Low-level mixed waste is managed under RCRA and shipped offsite for disposal at commercial disposal sites in compliance with site-specific waste acceptance criteria.

3.9.3 DOE Order 5400.5, Radiation Protection of the Public and the Environment

DOE Order 5400.5 sets radiation protection standards for DOE operations so that radiation exposures to members of the public and the environment are as low as reasonably achievable (ALARA) or maintained within established limits of the order. Table 3-2 provides a summary of SNL/CA compliance with this order in 2002.

3.10 Water Quality and Protection

SNL/CA is subject to the requirements of the Clean Water Act and equivalent California statutes. SNL/CA is not currently subject to the requirements of the Safe Drinking Water Act, as the site does not operate a public water system. The site also is not involved in any environmental restoration activities for which Safe Drinking Water Act standards are being applied as clean-up goals.

3.10.1 Clean Water Act

The Clean Water Act regulates all direct discharges into navigable waters of the U.S. (33 USC § 1251). Direct discharges to waters of the U.S. require permits issued under the National Pollutant Discharge Elimination System (NPDES). In California, the State Water Resources Control Board has authority from EPA to implement the Clean Water Act. Federal permitting requirements are included in Waste Discharge Requirements issued by Regional Water Quality Control Boards.

Table 3-2 Order 5400.5 Compliance Summary, 2002

Order 5400.5 Requirement	SNL/CA 2002 Summary
Maximum exposure to members of public = 100 mrem/yr	There were no radionuclide emissions in 2002. Additionally, the average annual direct radiation measurements for 2002 showed a difference of only 3.2 mrem between perimeter and distant locations.
Adopt ALARA exposures	ALARA is incorporated into ES&H policy, ES&H manual, and site operating procedures.
Control release of liquid radioactive wastes to the environment	No intentional discharges of liquid wastes to the environment occur onsite. No accidental releases of liquid radioactive waste occurred in 2002.
Control burial of low-level waste	Disposal of low-level waste <u>does not</u> occur onsite. ES&H procedures, manuals, and management systems are incorporated into site operations to ensure proper handling and disposal of radioactive materials.
Control radioactive releases to the sanitary sewer	Radioactive releases to the sanitary sewer are not allowed at SNL/CA. ES&H procedures, manuals, and management systems are incorporated into site operations to ensure proper handling and disposal of radioactive materials.
Implement environmental monitoring and surveillance	An environmental monitoring and surveillance program has been in place at SNL/CA for more than 30 years.
Control the release of property with residual radioactivity	SNL/CA <u>does not</u> release any property to the public with residual radioactivity above authorized limits. Excess property of this type is either transferred to other DOE facilities for reuse or transferred to Waste Management for disposal.
Dose evaluations	There were no radionuclide emission sources in 2002; therefore, there is no monitoring data available for dose evaluations. The average annual direct radiation measurement at the site perimeter in 2002 was 66.0 mrem, or 3.2 mrem more than distant locations, where the average annual dose was 62.8 mrem.

Wastewater Discharge

Wastewater generated at SNL/CA is discharged to the City of Livermore Water Reclamation Plant, a publicly owned treatment works (POTW). The Livermore POTW maintains an NPDES permit, and then regulates industry discharges into their sewer system. A Wastewater Discharge Permit issued by the Livermore POTW regulates SNL/CA's wastewater discharges. The permit is updated annually and includes discharge limits for the site sanitary sewer outfall and for processes subject to EPA pretreatment standards. Permit exceedances that occurred in 2002 are presented in Table 3-3.

Table 3-3 Wastewater Discharge Permit Exceedances at Sanitary Sewer Outfall, 2002

Parameter	No. of Samples Taken	No. of Compliant Samples	Percent Compliance	Date(s) of Exceedance	Description	Status / Resolution
Copper	52	51	98	1/06/02	Copper concentration was 2.6 mg/l. Discharge limit is 1.0 mg/l.	Probable source was determined to be a cooling tower. An ion exchange unit was installed to treat water prior to discharge to the sanitary sewer.

SNL/CA has three categorical processes that are subject to EPA's pretreatment standards, two metal finishing operations and a semiconductor manufacturing operation.² One of the metal finishing operations is a closed-loop process and does not discharge any effluents. Wastewater generated from the two processes that have effluents is sampled and monitored as part of the Environmental Monitoring, Restoration, and Surveillance Program. No exceedances of the discharge limits from these sources occurred during 2002.

Storm Water Discharge

General storm water discharges at SNL/CA are covered under the *State of California NPDES General Permit for Storm Water Discharge Associated with Industrial Activities* (General Permit) (California Water Resources Control Board 1997). The General Permit requires SNL/CA to implement a storm water pollution prevention plan. The SNL/CA plan describes the rationale for monitoring discharge locations and identifies best management practices for reducing pollutant contact with storm water.

Storm water discharges from construction areas at SNL/CA are covered under the *State of California NPDES General Permit for Storm Water Discharges Associated with Construction Activity* (General Construction Permit) (California Water Resources Control Board 1999). During 2002, SNL/CA exceeded the five-acre threshold for construction

² The semiconductor manufacturing operation is a research and development activity exempt from local air pollution regulations.

activities, requiring the site to apply for coverage under the General Construction Permit. Coverage was granted on June 4, 2002. In compliance with the General Construction Permit, SNL/CA implemented a construction storm water pollution prevention plan.

In 2002, twenty-two storm water discharge locations were visually monitored and nine locations were sampled. The result of monitoring and sampling activities conducted in 2002 did not identify any issues of concern. A summary of results for 2002 is presented in Section 5.1.

3.11 Executive Order 13148

Executive Order 13148, Greening of the Government Through Leadership in Environmental Management (EO 13148), directs federal agencies to integrate environmental accountability into day-to-day decision making and long-term planning processes. Table 3-4 presents the activities conducted at SNL/CA in support of this executive order.

3.12 Audits and Assessments

In 2002, five environmental program audits were conducted at SNL/CA. Three of the five audits were conducted by external agencies, two in the Waste Management Program and one in the Environmental Monitoring, Surveillance, and Restoration Program. The two internal audits included a self-audit in the Waste Management Program, and the DOE Contractor Performance Assessment Program (CPAP) audit.

3.12.1 Nevada Radioactive Waste Acceptance Program Compliance Audit

From May 21 through May 23, 2002, the National Nuclear Security Administration, Nevada Operations, audited SNL/CA for compliance with the Nevada Radioactive Waste Acceptance Program. This audit is conducted biennially. The audit declared the SNL/CA low-level waste management program effective and noted four corrective action requests for improvement. Corrective action plans were completed by SNL/CA in September 2002, and accepted by the Nevada Radioactive Waste Acceptance Program in November 2002.

3.12.2 City of Livermore Wastewater Audit

On November 14 2002, the City of Livermore inspected the SNL/CA sewer outfall and the two discharging categorical processes. (See Section 5.2.3 for a description of categorical processes at SNL/CA.) Wastewater samples were collected for analyses. Additional monitoring of the semiconductor categorical process was conducted on December 16, 2002. No areas of non-compliance were noted during the audit.

3.12.3 California Department of Toxic Substances Control Hazardous Waste Audit

On December 19, 2002, the DTSC audited SNL/CA hazardous waste management activities. No findings or corrective actions were identified.

Table 3-4 SNL/CA Activities in Support of Executive Order 13148

E.O. 13148 Goal	SNL/CA Activity
Develop and implement environmental management system	Incorporated into the corporate Integrated Safety Management System.
Establish and implement environmental compliance audit programs and policies that emphasize pollution prevention	SNL/CA's ES&H Interdisciplinary Team process ensures that each new and modified project is evaluated for pollution prevention and waste minimization opportunities. Additionally, SNL/CA maintains a Pollution Prevention and Waste Minimization Program that periodically conducts pollution prevention opportunity assessments, and assists site customers in implementing new processes to reduce pollution and waste.
EPCRA Reporting	Conducted annually.
Reduce reported Toxic Release Inventory (TRI) releases and off-site transfers of toxic chemicals for treatment and disposal	SNL/CA meets the TRI reporting threshold for lead only. Lead releases are generated from activities at the firing range. To reduce TRI releases, a change in ammunition type, would be required. Because DOE dictates the ammunition type used at SNL/CA, any changes would need to come from DOE.
Reduce use of toxic chemicals, hazardous substances, and pollutants, or generation of hazardous and radioactive waste types	SNL/CA maintains a Pollution Prevention and Waste Minimization Program to identify waste minimization opportunities and to assist site customers in implementing new processes to reduce pollution and waste.
Reduce use of ozone-depleting substances (ODCs)	SNL/CA complies with the regulations contained in 40 CFR 82 that are designed to end production of ODCs, supports recycling of ODCs during servicing and disposal, and identifies alternatives for ODCs.
Promote sustainable management of federal lands through cost-effective, environmentally sound landscaping practices, and programs to reduce adverse impacts to the natural environment	Site landscaping practices follow the SNL/CA Visual Quality Guidelines and Landscape Master Plan that incorporates the use of drought tolerant and native plant species into landscape design.

3.12.4 DOE CPAP Audit

From August 5 through 8, 2002, DOE evaluated contractor performance at SNL/CA. The scope of the audit included:

- Biosurety
- Configuration Management
- Explosives Safety
- Laser Safety
- Local Exhaust Ventilation
- Packing and Transportation
- Quality Assurance
- Standards and Requirements
- Waste Management
- Chronic Beryllium Disease Prevention Program

SNL/CA received six findings from the CPAP audit. Auditors also identified fifteen observations and eighteen noteworthy practices. Three findings, three observations, and five noteworthy practices relate to environmental operations. One of the eighteen noteworthy practices, the ES&H Interdisciplinary Team, is part of the site environmental management system. Where possible, corrective actions for environmental findings and observations were implemented immediately. Corrective actions for all other environmental findings and observations were prepared and submitted to DOE in January 2003. Implementation of corrective actions is pending DOE acceptance.

3.12.5 Internal Waste Management Program Audit

On March 19 through 21, 2002, SNL/CA conducted an annual internal audit of low-level radioactive waste management activities, in compliance with the requirements of DOE's Nuclear Safety Management regulations (10 CFR 830). The audit found SNL/CA activities to be adequate and effective. Three deficiencies identified during the audit were resolved by May 2002.

3.13 Environmental Occurrences

SNL/CA had two environmental occurrences in 2002. The first occurred on January 6, 2002, when the site discharge limit for copper was exceeded in the sanitary sewer (see Table 3-3). Wastewater samples collected at the sewer outfall on January 6, 2002 showed a copper concentration of 2.6 mg/L. The discharge limit for copper is 1.0 mg/L. An investigation was conducted to determine the source of the copper. The investigation isolated a specific water distribution system and cooling tower. Corrective actions were implemented to minimize

potential for reoccurrence. As a result of the copper exceedance, SNL/CA received a Notice of Violation from the Livermore Water Reclamation Plant on January 29, 2002.

The second environmental occurrence in 2002 was issued on December 23 for inadvertently discarding archived daily wastewater samples prior to receipt of the analytical results for a weekly composite sample. Under the site wastewater discharge permit, SNL/CA is required to analyze daily samples when the weekly concentration exceeds half of the permit limit. The weekly concentration for the October 15 - 25, 2002 period showed a copper concentration of 0.93 mg/l. The site limit is 1.0 mg/l. SNL/CA received a warning from the City of Livermore, Water Resources Division because the daily samples had been discarded and were not available for analyses.

3.14 Permits

Environmental permits and clean-up orders held by SNL/CA are listed in Table 3-5. Additional information is provided in previous sections under the relative program or regulation.

Table 3-5 SNL/CA Environmental Permits and Orders, 2002

Type	Description	Effective Date	Statute / Regulation	Issuing Agency
Air	Permit to Operate 24 emission sources: 10 Boilers 1 Degreaser 1 Paint spray booth 1 Service station 1 Chromium electroplating operation 5 Miscellaneous (decontamination sink, waste compactor, drum crusher, two sitewide sources for solvent emissions) 5 Emergency generators	July 1, 2002 through June 30, 2003	Clean Air Act	Bay Area Air Quality Management District
Environmental restoration	Site Clean-up Order No. 89-184	December 1989 (no expiration date)	California Water Code	Regional Water Quality Control Board, San Francisco Bay
Hazardous waste	RCRA Hazardous Waste Facility Permit	January 1993 through January 2003 ^a	Resource Conservation and Recovery Act	California Department of Toxic Substances Control
Wastewater	Wastewater Discharge Permit	August 2002 through July 2003	Clean Water Act	City of Livermore Water Reclamation Plant
Storm water	State of California General Permit	July 1997 through July 2002 ^b	Clean Water Act	State of California Water Resources Control Board
Storm water	State of California General Construction Permit	June 2002 through December 2006	Clean Water Act	State of California Water Resources Control Board
Underground storage tank	Permit to Operate	March 1, 2002 through February 28, 2003	Resource Conservation and Recovery Act and California Health and Safety Code	Alameda County Environmental Health Department

^a Although the current Hazardous Waste Facility Permit has expired, conditions of the permit allow SNL/CA to operate under the expired permit while the permit renewal application is under review by the State.

^b Permit renewal by the State of California is currently underway. When the renewal process is complete and a new General Permit is issued by the State, SNL/CA will apply for coverage under the new permit.

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4 Environmental Program Information

Environmental compliance at Sandia National Laboratories, California (SNL/CA) is achieved through implementation of various environment, safety, and health (ES&H) policies and principles. This chapter describes the environmental management structure at SNL/CA and presents environmental performance measurements for 2002. SNL/CA environmental programs are also identified and 2002 highlights for each program are provided.

4.1 Environmental Management

SNL/CA follows the corporate Integrated Safety Management System (ISMS) for safety and environmental management, and the corporate ES&H policy for environmental compliance. The corporate ES&H manual, also a component of the environmental management system, provides guidance to the Sandia workforce in meeting compliance requirements.

ISMS is comprised of five management functions: work planning; analysis of the hazards; development and implementation of hazard controls; performance of work within established controls; and provision of feedback for continuous improvement. Sandia Corporation is working to enhance the elements of ISMS to improve the environmental management framework at Sandia facilities. Corporate-wide enhancements will be folded into SNL/CA's existing environmental management system.

The ES&H policy incorporates the principle of ALARA (as low as reasonably achievable), assigns responsibility for ES&H conduct, and mandates the requirements for compliance.

The ES&H manual is a comprehensive document that guides the Sandia workforce through compliance with applicable environmental requirements. The manual describes the basics of the ES&H Program: why, what, how, and who. It identifies the boundaries of the program, describes how requirements flow down to Sandia organizations, and defines ES&H roles and responsibilities.

ES&H Policy

The policy of Sandia Corporation is to protect and preserve the environment and safety and health of its personnel, contractors, visitors, and the public. Sandia shall make deliberate efforts to reduce hazardous exposures and releases to as low as reasonably achievable considering technical, economic, and social factors.

Concern and conduct in matters pertaining to ES&H are the responsibility of all Sandia employees, contractors, and visitors.

Sandia's corporate ES&H program mandates compliance with all applicable laws, regulations, and DOE directives (included in the Management and Operating Contract) and adherence to the principles of line management responsibility for ES&H.

Many groups and programs support environmental management at SNL/CA. The site maintains an Environmental Operations Department that supports all aspects of environmental compliance; an ES&H Interdisciplinary Team that supports the five management functions of ISMS; ES&H councils and committees; and a formal self-assessment program that evaluates environmental performance. Environmental management is also enhanced through routine audits from DOE and external regulating agencies.

4.2 Environmental Performance

Environmental performance at SNL/CA is evaluated as part of the Department of Energy (DOE) Appraisal Agreement for Sandia National Laboratories, as a whole. The Appraisal Agreement is a jointly negotiated document that defines specific performance objectives, performance measures, and performance expectations to be evaluated each fiscal year. Each performance measure is assigned a numerical score that corresponds to one of 5 ratings:

- Outstanding
- Excellent
- Good
- Marginal
- Unsatisfactory

In fiscal year 2002, SNL/CA was evaluated against five environmental measures. These measures and performance ratings are presented in Table 4-1. The performance rating represents Sandia corporate results, of which SNL/CA is a part.

Table 4-1 Environmental Performance Measures Applicable to SNL/CA Operations, 2002

Performance Measure	Performance Rating
Environmental Compliance: tracks violations and noncompliance occurrences	Excellent
Integrated Safety Management System: evaluates program maintenance and improvement, and line implementation	Excellent
Preventing Pollution and Conserving Resources: compares against goals for waste generation, recycling, and purchasing of environmentally preferable products	Good
Disposal of Radioactive Waste: evaluates progress towards reducing inventory of legacy waste	Excellent
Radiation Protection and Operations: evaluates against elements of ISMS	Excellent

4.3 Environmental Programs

SNL/CA maintains an Environmental Operations Department that is comprised of five functional program areas. Program areas and primary elements of each are as follows:

- Air Quality – non-radiological emission source evaluation and permitting
- Environmental Monitoring, Restoration, and Surveillance – wastewater, storm water, and groundwater monitoring for radiological and non-radiological constituents; ambient surveillance for external radiation exposures; environmental restoration and remediation; and radionuclide air emission compliance
- Environmental Planning – National Environmental Policy Act (NEPA) reviews; ecological resource management; cultural and historic resource reviews; and general environmental reporting
- Pollution Prevention and Waste Minimization – pollution prevention opportunity assessments (PPOA); recycling programs; supports site-wide waste reduction; and supports affirmative procurement program
- Waste Management – hazardous, radioactive, and mixed waste management; Resource Conservation and Recovery Act (RCRA) permitting; and operation of onsite waste storage facilities

4.3.1 Environmental Program Highlights

Air Quality Program

In 2002, SNL/CA permitted 24 emission sources with the Bay Area Air Quality Management District (BAAQMD). Although this is an increase of four from 2001, the number of permitted sources has decreased since 1996 when SNL/CA operated 29 permitted sources. Additionally, the number of sources listed as exempt on the SNL/CA BAAQMD Permit to Operate decreased from 34 in 1996 to twelve in 2002. Emission rates from the 2002 permitted sources are presented in Tables 4-2 and 4-3.

Table 4-2 Criteria Pollutant Emission Rates at SNL/CA

Pollutant	2002/2003 Emissions (kg/yr) ^a
Particulates	374.2
Volatile organic compounds ^b	2897.4
Nitrogen oxides	2947.0
Sulfur dioxide	16.6
Carbon monoxide	500.0

a Annual emissions were calculated by multiplying the daily emissions reported in the BAAQMD Permit to Operate by 365.

b Assumes all organics reported on the BAAQMD Permit to Operate are volatile organic compounds.

Table 4-3 Toxic Emission Rates at SNL/CA

Pollutant	2002/2003 Emissions (kg/yr)^a
Formaldehyde	3.3
Methyl alcohol	854.3
Perchloroethylene	56.3
Toluene	48.0
Trichloroethylene	34.8
Xylene	18.2
1,4-dioxane	5.0
Methylene chloride	92.7
1,1,1-Trichloroethane	14.9
Hydrochloric acid mist	28.1

^a Annual emissions were calculated by multiplying the daily emissions reported in the BAAQMD Permit to Operate by 365.

New BAAQMD regulations limiting the type of cleaning solvents that can be used will go into effect in June 2003. These regulations are designed to reduce the volatile organic compound emissions throughout the San Francisco Bay Area. In preparation for these new regulations, SNL/CA's Air Quality Program has been assisting facility personnel with finding alternative cleaning solvents for onsite use.

Environmental Monitoring, Restoration, and Surveillance Program

Highlights of the Environmental Monitoring, Restoration, and Surveillance Program for 2002 include an underground storage tank investigation, a copper investigation, a drain survey, and a biological dose assessment. Routine compliance and monitoring activities conducted by the Environmental Monitoring, Restoration, and Surveillance Program are presented in Chapter 3 and 5, respectively.

In September 2002, an underground storage tank, containing soapy water, was discovered onsite during demolition of a mobile office complex. Upon discovery, an investigation into previous tank use was initiated. Discussions with knowledgeable personnel were held, and a sample of the water was collected and analyzed for metals and organics. Results of discussions with site personnel revealed that the tank had been used for water storage in support of past research activities (Holland 2002). Analytical results showed two constituents above detection limits, butyl carbitol and zinc. Butyl carbitol is commonly found in detergent and the zinc concentration was well below regulatory thresholds. Because only water was stored in the tank, it was not regulated by Alameda County and soil sampling under the tank was not warranted. The tank was transported offsite for recycling as scrap metal.

As a result of the copper exceedance that occurred at the sewer outfall in January 2002 (see sections 3.10 and 3.13), an extensive investigation was initiated to determine potential

sources of the copper. The investigation was a coordinated effort between Facilities and Environmental personnel. Through this investigation, the source of copper was traced back to an out-of-service water line and a cooling tower. The water line was capped to prevent continued accumulation of metals. Water and sludge from the cooling tower was transported offsite for treatment and disposal as non-hazardous waste. In June 2002, a portable ion exchange system was purchased to remove elevated concentrations of metals from cooling tower water prior to discharging to the sanitary sewer. The ion exchange system was used periodically in 2002 to reduce copper concentrations to an acceptable level.

A survey of all laboratory sinks and drains was completed during the summer of 2002. Data collected during the survey includes sink connections to the sewer, sink connections to a liquid effluent control system, and the types and quantities of chemicals used in each laboratory. The data will be used to control wastewater sources and for tracking potential sources of pollutants.

SNL/CA conducted a biological dose assessment for 2002 following DOE's technical standard, *A Graded Approach for Evaluating Doses to Aquatic and Terrestrial Biota* (DOE 2002a). The technical standard includes spreadsheet models for calculating doses from sediment and water radionuclide concentration data. The first step in the graded approach is a general screening to compare concentrations of radionuclides in environmental media with derived concentration guides. The ratios of the concentrations to the concentration guides are then summed. If the total equals or exceeds one then further analyses are required.

The radionuclides handled in greatest quantity at SNL/CA during present or past operations are tritium and depleted uranium. Therefore, these were the radionuclides assessed for dose to biota. Co-located samples of storm water runoff and sediment collected from the Arroyo Seco, where it exits the site, were input into the spreadsheet model. The sum of fractions from both sediment and water totaled 4.8×10^{-4} . This small fraction indicates that further analysis is not required and that SNL/CA is not required to monitor aquatic and terrestrial biota.

Environmental Planning Program

A major focus of the Environmental Planning Program during 2002 was support to DOE on the site-wide environmental assessment and the site-wide biological assessment (See Section 3.2, and 3.4, respectively). Acceptance and approval of both documents will further SNL/CA's progress in integrating ecological management with facility management and site operations.

Other activities conducted in 2002 included publication of informational sources, surveying for sensitive species, and project-specific NEPA reviews. Environmental Planning issued the final Environmental Information Document that provided baseline data for the site-wide environmental assessment process. The program continued to promote environmental awareness at SNL/CA by preparing and releasing, the *Wild Side of Sandia*, an educational brochure highlighting site wildlife and ecology. Environmental Planning conducted two project-specific surveys for California tiger salamanders. Tiger salamanders were not found

during these surveys. The most recent sighting of a tiger salamander at SNL/CA was on January 6, 2003. In fiscal year 2002, the program reviewed 106 actions in accordance with the SNL/CA NEPA Administrative Procedure (SNL/CA 2002a). Of these, 94 actions were covered under existing NEPA documentation and 12 were referred to DOE for NEPA determinations. All actions referred to DOE were categorically excluded from the need to prepare an environmental assessment or environmental impact statement.

Pollution Prevention and Waste Minimization Program

The Pollution Prevention and Waste Minimization Program completed a site-wide PPOA in 2002. The process consisted of gathering data, analyzing waste generation and energy use, and identifying large waste generators. The information was used to identify opportunities for waste reduction. Thirteen operational areas were assessed under the PPOA and rated for potential environmental improvement. In 2003, specific PPOAs will be prepared for the four areas with the highest rating.

The Pollution Prevention and Waste Minimization Program successfully promoted equipment and resource reuse during the year. Program efforts resulted in disposition of equipment at a cost savings to SNL/CA of \$6,000, and onsite reuse of portable buildings/storage units that would otherwise have been disposed as solid waste at the local landfill. Building reuse saved an estimated 7850 kg of solid waste.

In 2002, SNL/CA recycled 168.02 metric tons of material, excluding yard waste. Table 4-4 presents the quantity of each item recycled during the year. Figure 4-1 depicts total quantity of materials recycled annually since 1999 (excludes yard waste). As shown, the quantity of materials recycled at SNL/CA has increased each year.

Table 4-4 SNL/CA Recycling Data, 2002

Recycled Item	Quantity Recycled (metric tons)	Recycled Item	Quantity Recycled (metric tons)
Aluminum cans	5.42	Cardboard	11.47
Light tubes	1.01	Junk paper	3.35
Office paper	16.55	Scrap metals	83.73
Tires	1.86	Toner cartridges	0.78
Transparencies	0.07	Wood	34.41
Batteries	3.28	Engine oils	2.3
Coolant	1.26	Metal drums	0.03
Oil filters	0.21	Empty containers	0.59
Mercury	0.31	Resins	1.39

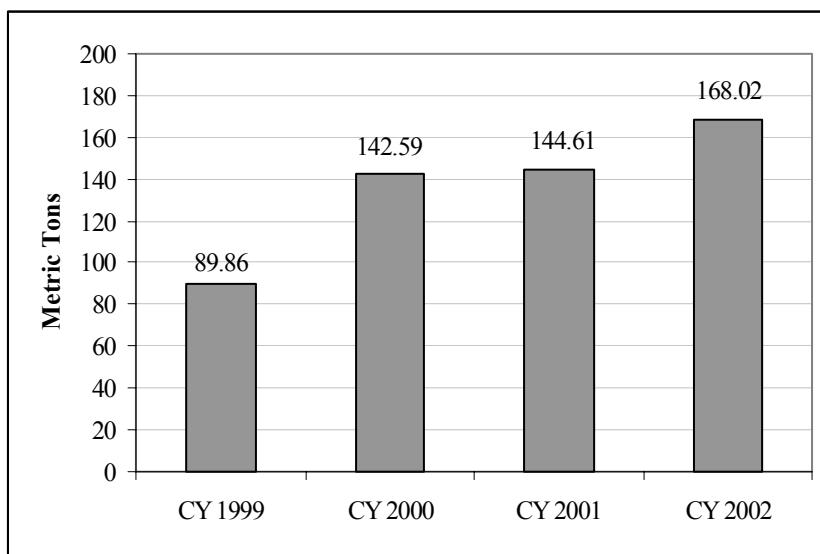


Figure 4-1 Total Recycled Materials at SNL/CA, 1999 to 2002

Noteworthy improvements were made in 2002 to decrease the quantity of medical waste generated at SNL/CA. During the year, the Medical Department and the Waste Management Program evaluated the process used to categorize medical waste. As a result of this evaluation, SNL/CA identified and implemented improvements in the disposal process for this waste type. With the new process in place, generation of medical waste at SNL/CA decreased from 197 kg in 2001 to 35 kg in 2002, an 82 percent decrease.

Waste Management Program

Highlights for the Waste Management Program in 2002 include closing Solid Waste Management Unit (SWMU) #10, renewal of a disposal path for mixed waste, continuing progress with disposal of radioactive waste, implementing a new chemical cleanout process, and beginning the renovation of the Hazardous Waste Storage Facility.

The closure process for SWMU #10 (Building 913) was initiated early in 2002 with preparation of a RCRA Facility Investigation Plan. Building 913 and associated underground utilities had been decontaminated and removed in 2001 to prepare the site for new construction. The Facility Investigation Plan outlines the sampling regime followed to determine if chemical contamination³ was present at the Building 913 site. In March 2002, the plan was approved by the California Department of Toxic Substances Control (DTSC), the regulating authority for RCRA in California. Soil samples were collected and analyzed for metals, organics, pesticides, and polychlorinated biphenyls. The investigation concluded that RCRA facility releases at Building 913 had been remediated to background levels and posed no further risk requiring continued corrective action. The results of the closure

³ Previous sampling and analyses conducted after removal of the building and underground utility systems found that radiological contamination was not present at the site and therefore radiological analyses were not conducted as part of the RCRA Facility Investigation.

investigation were submitted to DTSC in May 2002; DTSC accepted the results of the investigation in September 2002. Final approval to close SWMU #10 was received from DTSC on April 25, 2003.

In 2002, SNL/CA renewed a path for offsite disposal of mixed waste. The disposal facility meets the strict requirements for both DOE radioactive waste and California hazardous waste. The disposal path principally supports building demolition and closure of legacy waste management units dating back to the mid 1960s.

The Waste Management Program continued with characterization of site-wide legacy radioactive sources, consisting of over two hundred items of radioactive material with no further use. All sources are characterized for safe onsite storage and accountability, and are undergoing final characterization to meet Nevada Test Site disposal requirements. Packaging and disposal of items characterized during 2002 is expected to occur in 2003.

The Waste Management Program implemented a new chemical cleanout process in 2002 to reduce the number and quantity of chemicals in the site's inventory that do not have further use. Under the new process, SNL/CA contracts with a waste disposal company that provides an onsite service to inventory and package items slated for disposal. SNL/CA's Waste Management personnel coordinate individual cleanouts and provide oversight during the cleanout. Three chemical cleanouts were completed in 2002, contributing to the increase in RCRA waste generated during the year (Table 4-5).

In August 2002, SNL/CA began renovating the Hazardous Waste Storage Facility. The renovated facility will provide updated safety controls, a new loading dock, and enclosed storage bays. Loading and unloading operations will move to the south side of the facility where waste operations will be isolated from the Arroyo Seco, which is located immediately north. The movement of waste operations will safeguard the arroyo from accidental releases, should they occur in the future.

The Waste Management Program tracks and maintains a database of radioactive and hazardous waste generated at SNL/CA. Table 4-5 presents waste generation data for 2002. Data for 2001 is also included for comparison. Although not tracked by the Waste Management Program, sanitary waste is also shown.

Table 4-5 Waste Generated at SNL/CA, 2001 and 2002

Waste Type	CY 2001 (kg)	CY 2002 (kg)	Change (kg)	Percent Change
RCRA	18,359	38,985	20,626	112
California toxic (non-RCRA)	38,824	18,891	-19,933	-51
TSCA regulated	3,239	15,318	12,079	373
Biohazardous	197	35	-162	-82
Low-level radioactive	29,158	51	-29,107	-99
Low-level mixed	1,566	362	-1,204	-77
Sanitary	249,000	199,900	-49,100	-20

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5 Environmental Monitoring

Sandia National Laboratories, California (SNL/CA) monitors storm water, wastewater, groundwater, and direct (ambient) radiation. This chapter provides a summary of monitoring activities and results for each of these media. Both radiological and non-radiological data are presented.

SNL/CA does not monitor airborne effluents. There are no non-radiological (chemical) emission sources onsite that require routine monitoring. Similarly, there are no radionuclide emission sources that require routine monitoring. SNL/CA maintains an inventory of radioactive isotopes (small quantity sealed and unsealed sources), and operates several radiation generating devices. However, emission monitoring is not required for these materials and devices.

Typically, radiological emission data that would be obtained from radionuclide effluent monitoring is used to evaluate the potential effect that a particular sites operations may have on local populations and the environment. Because there are no radionuclide emission sources and no monitoring data for site operations, calculations for maximum individual dose or collective population dose are not possible. As an alternative to these calculations, SNL/CA compares direct radiation data collected at the site perimeter to offsite data. Results of this comparison are presented in Section 5.4.

SNL/CA is not required to monitor biota or vegetation. The Department of Energy (DOE) RAD-BCG Calculator, a computer tool developed by DOE, was used to determine the level of monitoring required. The results from applying the calculator tool show that biota and vegetation monitoring is not required at SNL/CA. Additional information on the calculator is presented in Chapter 4, Environmental Program Highlights.

5.1 Storm Water

All storm water runoff from SNL/CA is conveyed to the Arroyo Seco, which discharges into Alameda Creek and eventually to the San Francisco Bay. Storm water that flows off buildings, material-handling areas, parking lots, and other impervious surfaces, may pick up pollutants, such as oil and grease, soil, litter, pesticides, and fertilizers. During heavy or continuing storms, runoff may transport pollutants to Arroyo Seco before the storm water has time to evaporate or infiltrate into the ground.

To assess the impact of site operations to storm water discharges, SNL/CA collects samples of surface runoff at nine locations around the site. These locations, identified on Figure 5-1, were selected because they provide the best representation of drainage areas and activities onsite. Each of the nine locations is sampled twice each wet season, once each during two separate storm events. The wet season is from October 1 through May 31. Because any one

storm may not produce enough runoff to allow for sample collection at all nine locations, sampling during more than two storm events is generally required.

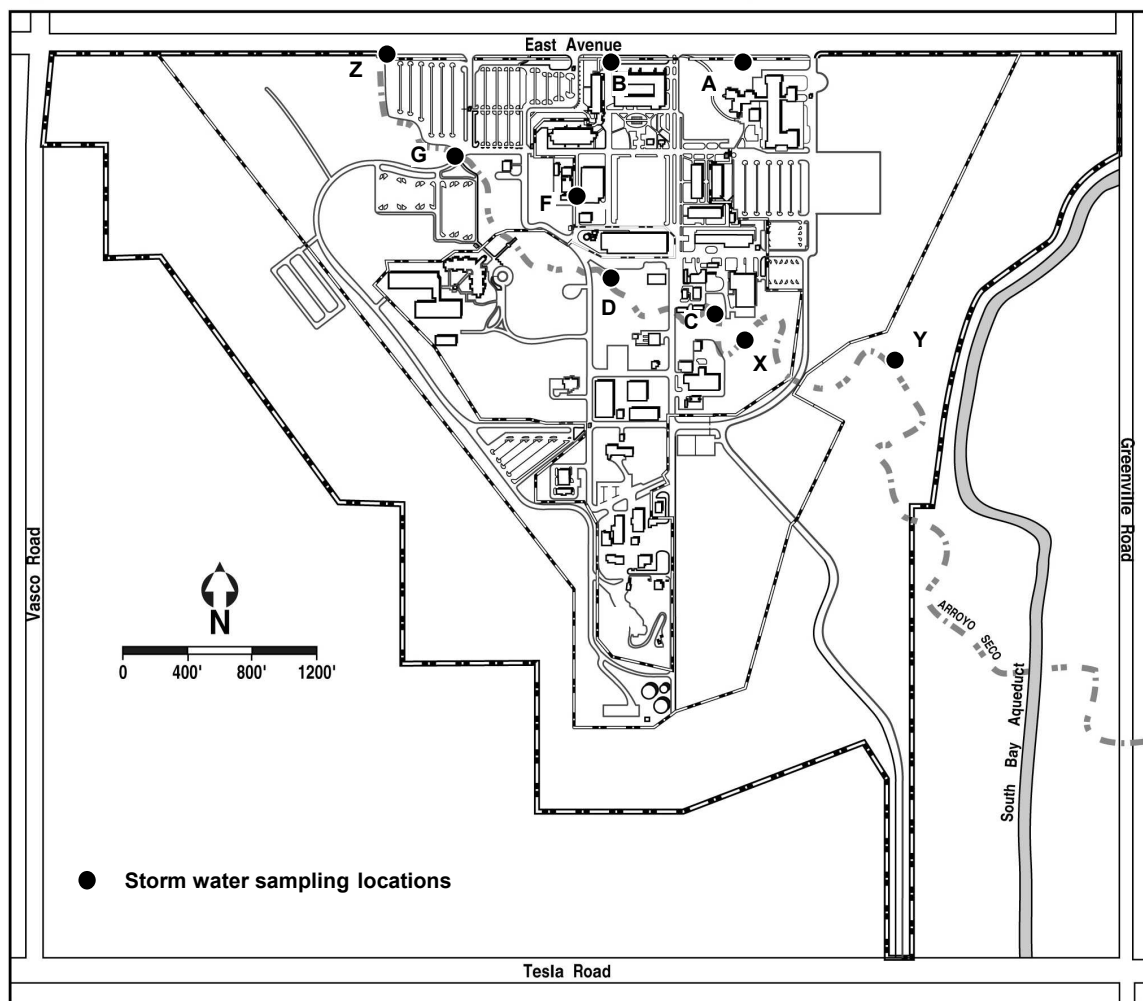


Figure 5-1 Storm Water Sampling Locations

Storm water discharges at SNL/CA are covered under the State of California NPDES General Permit for Storm Water Discharge Associated with Industrial Activities (General Permit) (California Water Resources Control Board 1997). The General Permit does not establish water quality standards for storm water discharges. Consequently, a comparison of analytical results with regulatory standards cannot be made. Instead the analytical data obtained from monitoring storm water discharge is used to optimize storm water pollution prevention activities at SNL/CA, and to identify trends.

Storm water samples collected at SNL/CA are analyzed for the following parameters:

- | | |
|--------------------------|--------------------------|
| ➤ specific conductivity | ➤ metals |
| ➤ pH | ➤ chemical oxygen demand |
| ➤ total suspended solids | ➤ nitrite + nitrate |
| ➤ oil and grease | ➤ ammonia |
| ➤ cyanide | ➤ tritium |

Analytical results of storm water sampling for the 2001/2002 wet season (October 2001 through May 2002) are presented in Table 5-1. No pollutants were detected in storm water runoff at levels that are a cause for concern. The concentrations of constituents detected in storm water are similar to those detected historically.

Annually, SNL/CA evaluates storm water pollution prevention practices at each drainage location as part of its monitoring activities. Pollution prevention practices were found to be adequate and no changes were warranted in 2002.

During years of sufficient runoff, SNL/CA compares the analytical results from storm water entering the site to storm water exiting the site. In 2002, there was insufficient runoff at the inlet location to collect samples for analyses. Consequently, a comparison could not be made.

5.2 Wastewater

Wastewater effluent generated at SNL/CA consists of sanitary and laboratory discharges. Sanitary effluent is discharged directly to the sewer system. Sewer discharges exit the site through a sewer outfall located at the northern boundary, and join with the Lawrence Livermore National Laboratory (LLNL) sewer system. Laboratory discharges are generated from general research activities, and from operations that qualify as categorical processes subject to Federal pretreatment standards. Laboratory effluent from most laboratory areas is diverted to liquid effluent control system (LECS) holding tanks prior to discharge to the sanitary sewer. SNL/CA monitors wastewater at the sewer outfall, LECS tanks, and at categorical process point sources.

5.2.1 Sewer Outfall

SNL/CA operates a sewer outfall and monitoring station at the northern site boundary to continuously monitor wastewater for flow and pH. Samples are also collected at the outfall to monitor compliance with wastewater discharge limits established in the site's *Wastewater Discharge Permit*. The outfall sampling schedule and analytical parameters are presented in Table 5-2. Consistent with permit requirements, SNL/CA does not analyze wastewater samples collected at the sewer outfall for radioactive constituents.

Table 5-1 Summary of Analytical Results for Storm Water, 2001/2002 Wet Season

Parameter	Number of Samples Analyzed	Number Found Below Detection Limit	Detection Limit	Minimum Concentration	Maximum Concentration
Total suspended solids	11	0	3 mg/L	5 mg/L	410 mg/L
Specific conductivity	11	0	1 μ mho/cm	33 μ mho/cm	68 μ mho/cm
pH	11	0	None	5.1	6.1
Oil and grease	11	8	1 mg/L	<1.0 mg/L	1.6 mg/L
Chemical oxygen demand	11	0	5 mg/L	23 mg/L	120 mg/L
Cyanide	11	11	0.01 mg/L	<0.01 mg/L	<0.01 mg/L
Tritium	8	8	675 pCi/L	<675 pCi/L	<675 pCi/L
Aluminum	11	0	0.05 mg/L	0.13 mg/L	3.7 mg/L
Arsenic	11	11	0.005 mg/L	<0.005 mg/L	<0.005 mg/L
Cadmium	11	11	0.002 mg/L	<0.002 mg/L	<0.002 mg/L
Iron	11	0	0.12 mg/L	0.12 mg/L	6.2 mg/L
Lead	11	6	0.005 mg/L	<0.005 mg/L	0.016 mg/L
Magnesium	11	0	0.10 mg/L	0.6 mg/L	3.0 mg/L
Mercury	11	11	0.0002 mg/L	<0.0002 mg/L	0.0007 mg/L
Selenium	11	11	0.0002 mg/L	<0.002 mg/L	<0.002 mg/L
Silver	11	11	<0.005 mg/L	<0.005 mg/L	<0.005 mg/L
Zinc	11	0	0.02 mg/L	0.13 mg/L	0.30 mg/L
Ammonia-N	11	11	0.5 mg/L	<0.5 mg/L	<0.5 mg/L
Nitrite + nitrate	11	10	0.05 + 1.0 mg/L	<0.05 + 1.0 mg/L	0.05 +7.0 mg/L

A summary of analytical results for physical parameters and metals from the SNL/CA sanitary sewer outfall is presented in Table 5-3. In 2002, all liquid effluent from the outfall complied with the site outfall discharge limits for regulated physical parameters and most metals. The site exceeded the discharge limit for copper one time in 2002. The exceedance was found in a daily sample collected on January 6, 2002. Weekly monitoring results for 2002 are consistent with results obtained over the past ten years. Figures 5-2 and 5-3 show the trend in weekly monitoring results over this ten-year period. Because the data represent weekly composite analyses, Figures 5-2 and 5-3 do not include daily exceedances. As shown, the site has experienced a gradual upward trend in levels of both copper and zinc at the sewer outfall.

Table 5-2 Sewer Outfall Sampling Schedule, 2002

Frequency	Sample Type	Analytical Parameter
Daily	Composite	Archive sample; analyzed only when weekly composite sample shows concentration greater than or equal to 50% of discharge limit for metals.
Weekly	Composite	Metals
Monthly	Composite	Total dissolved solids Total suspended solids Biochemical oxygen demand Chemical oxygen demand
Biannually	Composite	Tributyl tin ^a
Monthly	Grab	Cyanide EPA priority organic pollutants

^a The requirement for tributyl tin analyses was removed from the discharge permit, effective August 2002.

Copper has been the pollutant of most concern at SNL/CA over the past few years. The last three exceedances of sanitary sewer discharge limits were copper exceedances. As noted in sections 3.10 and 3.13, SNL/CA has identified one source of copper contributing to the exceedance in 2002. Ongoing efforts will continue to identify other potential sources of copper in wastewater. Trends will be closely monitored so that controls can be implemented and impacts minimized.

Sewer outfall samples are also analyzed for priority pollutants that are listed by the U.S. Environmental Protection Agency (EPA) as toxic organics. Because the list is lengthy, SNL/CA routinely reports only positively identified organic constituents. In 2002, sewer outfall samples showed concentrations of chloroform (5 – 10 µg/L), acetone (25 – 310 µg/L), carbon disulfide (39 µg/L), and phenol (21 µg/L). All other constituents on the EPA toxic organic list were below minimum detection limits. The toxic organic discharge limit for the site is 1000 µg/L. In 2002, SNL/CA did not exceed this discharge limit.

5.2.2 Liquid Effluent Control System

Laboratory effluent is diverted to LECS holding tanks where wastewater can be sampled and analyzed prior to release to the sewer system. SNL/CA operates six LECS. Wastewater from LECS tanks is typically analyzed for metals. Analyses for other parameters associated with the process generating the wastewater, may also be done. Five of the LECS tanks are also continuously monitored for pH. One LECS tank is monitored every few years for tritium and uranium; however, in 2002, analyses for radioactive constituents were not warranted.

Wastewater that does not meet the discharge limits at the sewer outfall is transferred to Waste Management for disposal. Depending on the constituents of the wastewater, it may be disposed as hazardous or non-hazardous waste. In 2002, all SNL/CA laboratory wastewater met the discharge limits at the sewer outfall and was discharged to the sanitary sewer. Consequently, offsite disposal of laboratory wastewater collected in LECS tanks was not required.

Table 5-3 Weekly Composite Sewer Outfall Monitoring Results – Physical Parameters and Metals, 2002

Parameter	Number of Samples Analyzed	Quantity Found Below Detection Limit	Detection Limit	Sewer Discharge Limit	Minimum Concentration	Maximum Concentration
Total suspended solids	12	0	5 mg/L	None	86 mg/L	3100 mg/L
Total dissolved solids	12	0	5 mg/L	None	150 mg/L	1600 mg/L
Biochemical oxygen demand	12	0	5 mg/L	None	84 mg/L	2000 mg/L
Chemical oxygen demand	12	0	5 mg/L	None	200 mg/L	2200 mg/L
Cyanide	12	12	0.01 mg/L	0.04 mg/L	<0.01 mg/L	<0.01 mg/L
Tributyl tin	2	0	0.002 mg/L	None	30 mg/L	39 mg/L
Arsenic	46	26	0.005 mg/L	0.06 mg/L	<0.005 mg/L	0.013 mg/L
Cadmium	46	44	0.005 mg/L	0.14 mg/L	<0.005 mg/L	<0.007 mg/L
Chromium	46	10	0.01 mg/L	0.62 mg/L	<0.01 mg/L	0.07 mg/L
Copper ^a	46	0	0.01 mg/L	1 mg/L	0.029 mg/L	0.93 mg/L
Lead	46	46	0.05 mg/L	0.2 mg/L	<0.05 mg/L	<0.05 mg/L
Mercury	46	40	0.0005 mg/L	0.01 mg/L	<0.0005 mg/L	0.005 mg/L
Nickel	46	40	0.02 mg/L	0.61 mg/L	<0.02 mg/L	0.02 mg/L
Silver	46	40	0.01 mg/L	0.2 mg/L	<0.01 mg/L	0.012 mg/L
Zinc	46	0	0.02 mg/L	3 mg/L	0.14 mg/L	1.6 mg/L

^a Data does not include analytical results for daily samples. Therefore, the copper exceedance on January 6, 2002 of 2.6 mg/L is not shown in the table.

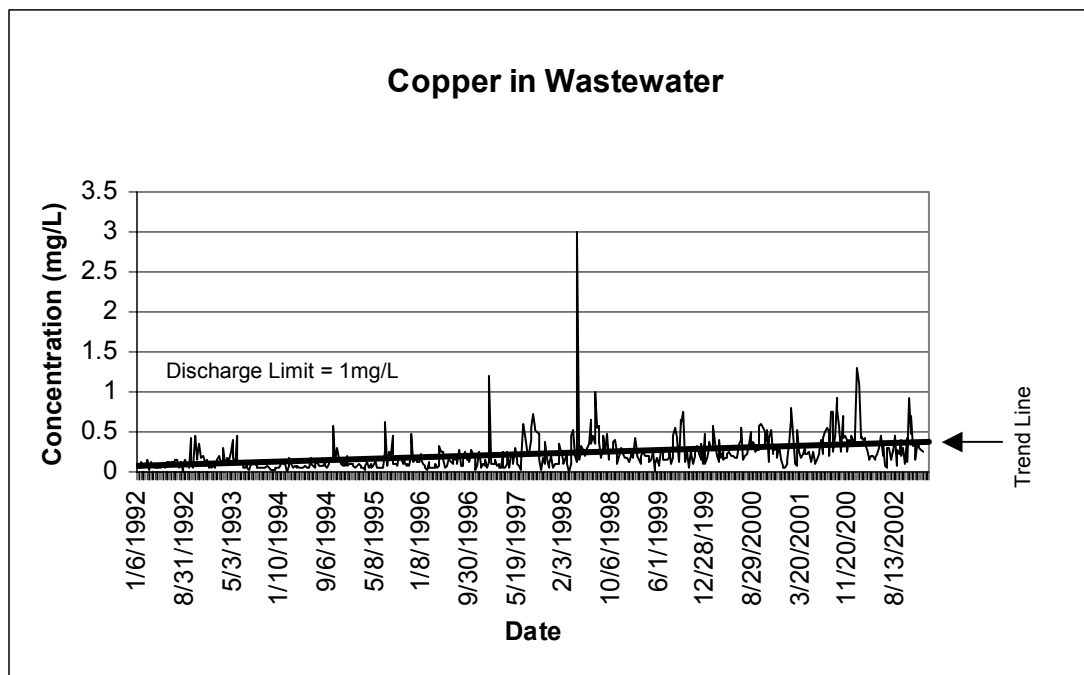


Figure 5-2 Copper Concentrations in Wastewater at the SNL/CA Sewer Outfall

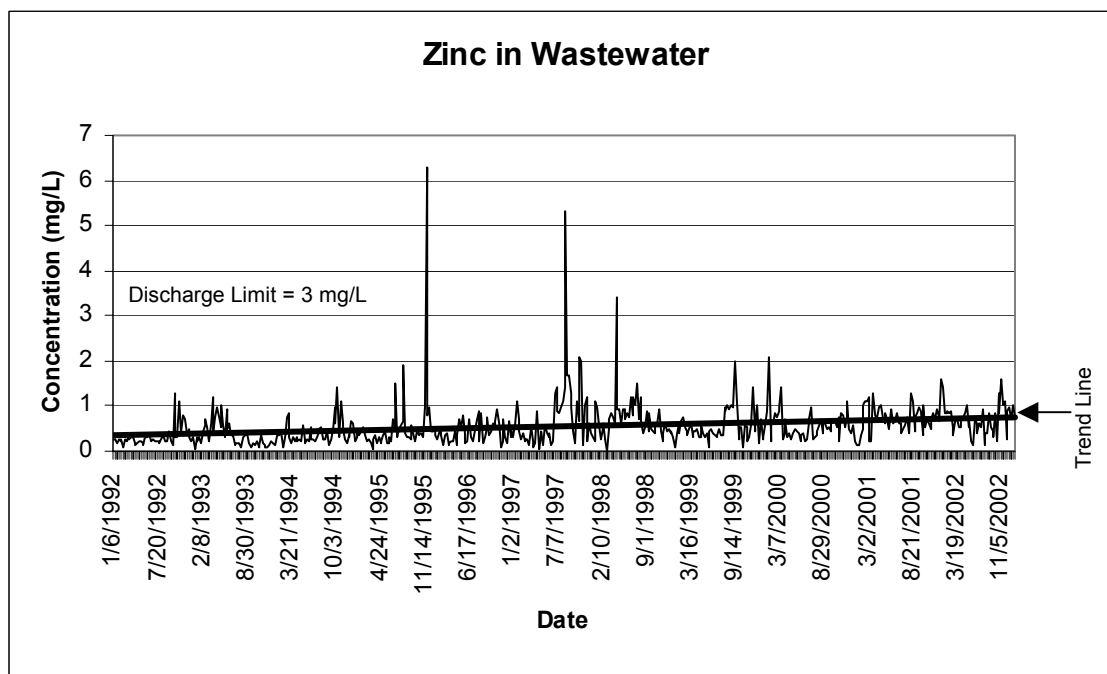


Figure 5-3 Zinc Concentrations in Wastewater at the SNL/CA Sewer Outfall

5.2.3 Categorical Processes

Three research operations at SNL/CA are defined as Federal categorical processes subject to the Environmental Protection Agency's pretreatment standards for point sources (40 CFR Part 403, 40 CFR Part 433). These categorical processes include two metal finishing operations and a semiconductor manufacturing operation.⁴ Wastewater from two of these processes is sampled semiannually. One of the metal finishing operations is a closed-loop system that does not discharge effluent to the sanitary sewer, and, therefore, wastewater monitoring is not required.

Samples collected from the metal finishing operation are analyzed for pH, arsenic, metals, and toxic organic pollutants. Samples collected from the semiconductor manufacturing operation are analyzed for pH, arsenic, and toxic organic pollutants.

A summary of semiannual monitoring results for the metal finishing operation is presented in Table 5-4. In 2002, semiannual monitoring of this operation showed that all wastewater met the pretreatment standards. Chromium, copper, and zinc were consistently seen above detection limits, while remaining below regulatory limits.

A summary of semiannual monitoring results for the semiconductor manufacturing operation is presented in Table 5-5. In 2002, all wastewater from this operation met the pretreatment standards.

5.3 Groundwater

SNL/CA has eight groundwater monitoring wells. Sandia monitors groundwater at three former restoration areas and along Arroyo Seco. Four groundwater monitoring wells are used to monitor residual contamination at former restoration areas under a 1989 site clean-up order issued by the Regional Water Quality Control Board, San Francisco Bay Region. Two of these wells are located at the Fuel Oil Spill site, and one each at the Trudell Auto Repair Shop site and the Navy Landfill. Four monitoring wells are located along Arroyo Seco to monitor the effect of site operations on groundwater quality. Well # AS-4 is located upgradient of the developed area of the site and provides background data about local groundwater quality. Groundwater monitoring well locations are shown on Figure 5-4. Table 5-6 provides the sampling schedule for each well location.

Summaries of groundwater analytical results are presented in Tables 5-7, 5-8, and 5-9. Complete groundwater analytical results are provided in Appendix A. As a point of reference, analytical results are compared to federal and state maximum contaminant levels (MCLs), which are applicable for drinking water sources. There are no wells at SNL/CA

⁴ The semiconductor manufacturing operation is a research and development activity exempt from local air pollution regulations.

used as a source for drinking water and MCLs are not standards applied to groundwater at the site.

Table 5-4 Batch Discharges and Monitoring for Metal Finishing Categorical Process, 2002

Parameter	Number of Samples Analyzed	Number Found Below Detection Limit	Detection Limit	Minimum Concentration	Maximum Concentration	Permit Limit ^a
pH	15	0	None	6.0	7.0	5-10 ^b
Arsenic ^c	15	14	0.005 mg/L	<0.005 mg/L	0.009 mg/L	None
Cadmium	15	15	0.005 mg/L	<0.005 mg/L	<0.005 mg/L	0.26 mg/L
Chromium	15	0	0.01 mg/L	<0.01 mg/L	0.67 mg/L	1.71 mg/L
Copper	15	1	0.001 mg/L	<0.01 mg/L	0.10 mg/L	2.07 mg/L
Lead	15	14	0.05 mg/L	<0.05 mg/L	0.06 mg/L	0.43 mg/L
Mercury ^c	15	12	0.0005 mg/L	<0.0005 mg/L	0.0010 mg/L	None
Nickel	15	15	0.02 mg/L	<0.02 mg/L	<0.02 mg/L	2.38 mg/L
Silver	15	9	0.01 mg/L	<0.01 mg/L	0.030 mg/L	0.24 mg/L
Zinc	15	14	0.02 mg/L	<0.02 mg/L	0.11 mg/L	1.48 mg/L
Cyanide	2	2	0.02 mg/L	<0.02 mg/L	<0.02 mg/L	0.65 mg/L
Total toxic organics	2	0	Range ^d	0.198 mg/L	0.198 mg/L	2.13 mg/L ^e

^a Monthly average.

^b Permit limit for site outfall.

^c Analyses for arsenic and mercury are not required. Results are reported for informational purposes only.

^d Detection limits for the various organics included in this value range from 0.005 to 0.130 mg/L.

^e The limit for total toxic organics is a daily maximum concentration.

Table 5-5 Monitoring for Semiconductor Manufacturing Categorical Process, 2002

Parameter	Number of Samples Analyzed	Number Found Below Detection Limit	Detection Limit	Minimum Concentration	Maximum Concentration	Permit Limit (daily max)
pH	2	0	None	5.2	5.9	6-9
Arsenic	2	2	0.002 mg/L	<0.002 mg/L	<0.002 mg/L	None
Total toxic organics	2	0	Range ^a	0.198 mg/L	0.198 mg/L	1.37 mg/L

^a Detection limits for the various organics included in this value range from 0.005 to 0.130 mg/L

As in past years, SNL/CA continued to detect carbon tetrachloride at the Navy Landfill well (NLF-6) and diesel at the Fuel Oil Spill Site in 2002. Concentrations detected in 2002 are similar to those detected in past years.

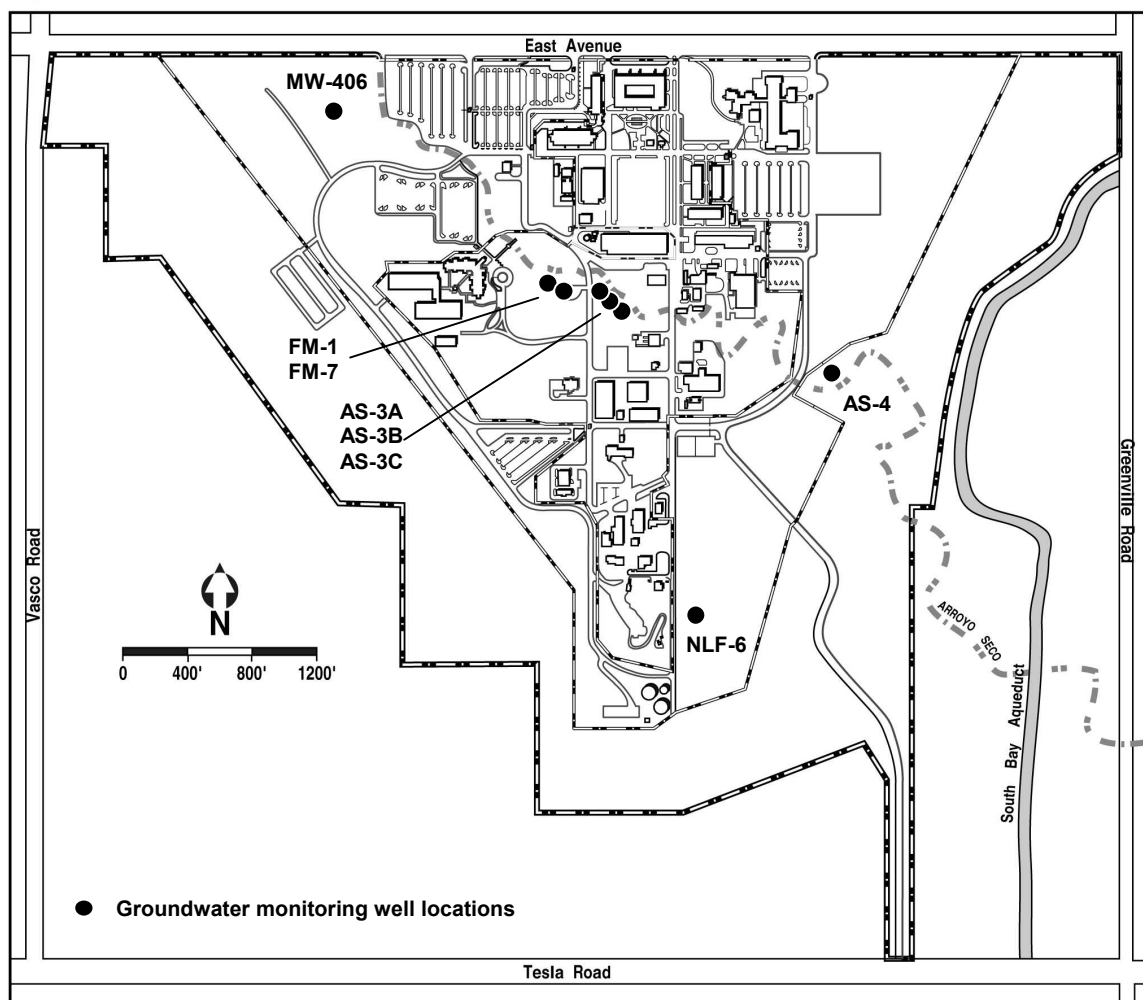


Figure 5-4 Groundwater Monitoring Well Locations

Table 5-6 Groundwater Sampling Schedule, 2002

Well location	Sampling frequency	Analytical parameter
Fuel Oil Spill site	Semi-annually	Benzene, toluene, ethylbenzene, and xylenes (BTEX) (EPA 602); total petroleum hydrocarbons diesel-methane (TPHD) (8015); water elevation
Trudell Auto Repair Shop site	Annually	Volatile halogenated organics (EPA 601); water elevation
Navy Landfill	Quarterly	Volatile halogenated organics (EPA 601); water elevation
Arroyo Seco	Annually	Metals, volatile halogenated organics (EPA 601), total petroleum hydrocarbons diesel-methane (8015), tritium, water elevation
Arroyo Seco	Every two years	General minerals

Table 5-7 Summary of Groundwater Analyses at Navy Landfill and Trudell Wells, 2002

	Date	Trichloromethane^a (chloroform) µg/L	Carbon Tetrachloride^a µg/L
Detection limit		0.5	0.5
MCL – California			0.5
MCL – Federal		100	5
Navy Landfill			
NLF-6	3/27/02	ND	1.1
NLF-6	6/17/02	ND	ND
NLF-6	9/24/02	ND	ND
NLF-6	11/13/02	0.56	0.94
Trudell			
MW-406	6/17/02	ND	ND

^a All other EPA 601 parameters were non-detectable.

MCL – Maximum contaminant levels.

ND – Non-detectable.

Table 5-8 Summary of Groundwater Analyses at Fuel Oil Spill Wells, 2002

	Date	BTEX (EPA 602) µg/L	Diesel (8015) µg/L
Detection limit		None	50
FM-1	2/26/02	ND	340
FM-1	6/17/02	ND	80000 ^a
FM-7	2/26/02	ND	310
FM-7	6/17/02	b	b

^a Although the diesel concentration was higher in FM-1 on 6/17/002, analytical results are consistent with historical data. Diesel concentrations at the FOS site have fluctuated over the last five years and have been as high as 610,000 µg/L.

^b FM-7 was dry on 6/17/02 and a sample could not be collected.

ND – Non-detectable.

Table 5-9 Summary of Groundwater Analyses at Arroyo Seco Wells, 2002

	Date	EPA 601	Diesel (8015) µg/L	General Minerals ^a		
				Barium mg/L	Cadmium mg/L	Nickel mg/L
Detection limit			50	0.005	0.005	0.01
MCL - California				1	0.01	
MCL – Federal				2	0.005	0.1
AS-3A	6/18/02	ND	ND	0.1	ND	0.2
AS-3B	6/18/02	ND	ND	0.1	ND	ND
AS-3C	6/18/02	ND	87 ^c	ND	ND	ND
AS-4	6/18/02	ND	ND	b	b	b

^a All other general mineral parameters were non-detectable.

^b Not analyzed for this parameter.

^c This result was noted by the analytical laboratory as not consistent with a fuel fingerprint. The result is most likely due to naturally occurring organic compounds.

MCL – Maximum contaminant levels.

ND – Non-detectable.

5.4 Direct Radiation

SNL/CA monitors direct radiation to ensure that site operations are not contributing significantly to the ambient radiation dose in the surrounding environment. Onsite sources that could contribute to direct radiation include small, unsealed radioactive isotopes, sealed sources, and several radiation generating devices. SNL/CA maintains four onsite monitoring stations equipped with thermoluminescent dosimeters. Monitoring stations are shown on Figure 5-5. The dosimeters are collected and evaluated quarterly. The data obtained from Sandia monitoring stations is combined with that from LLNL monitoring stations located around the perimeter of the Sandia site to determine the average annual external radiation

dose at the site perimeter. The combined dose is then compared to the average annual external radiation dose at more distant locations in the Livermore Valley, shown on Figure 5-6. If site operations were contributing significantly to the external radiation dose, the dosimeters at the site perimeter would show a higher dose than those at more distant locations.

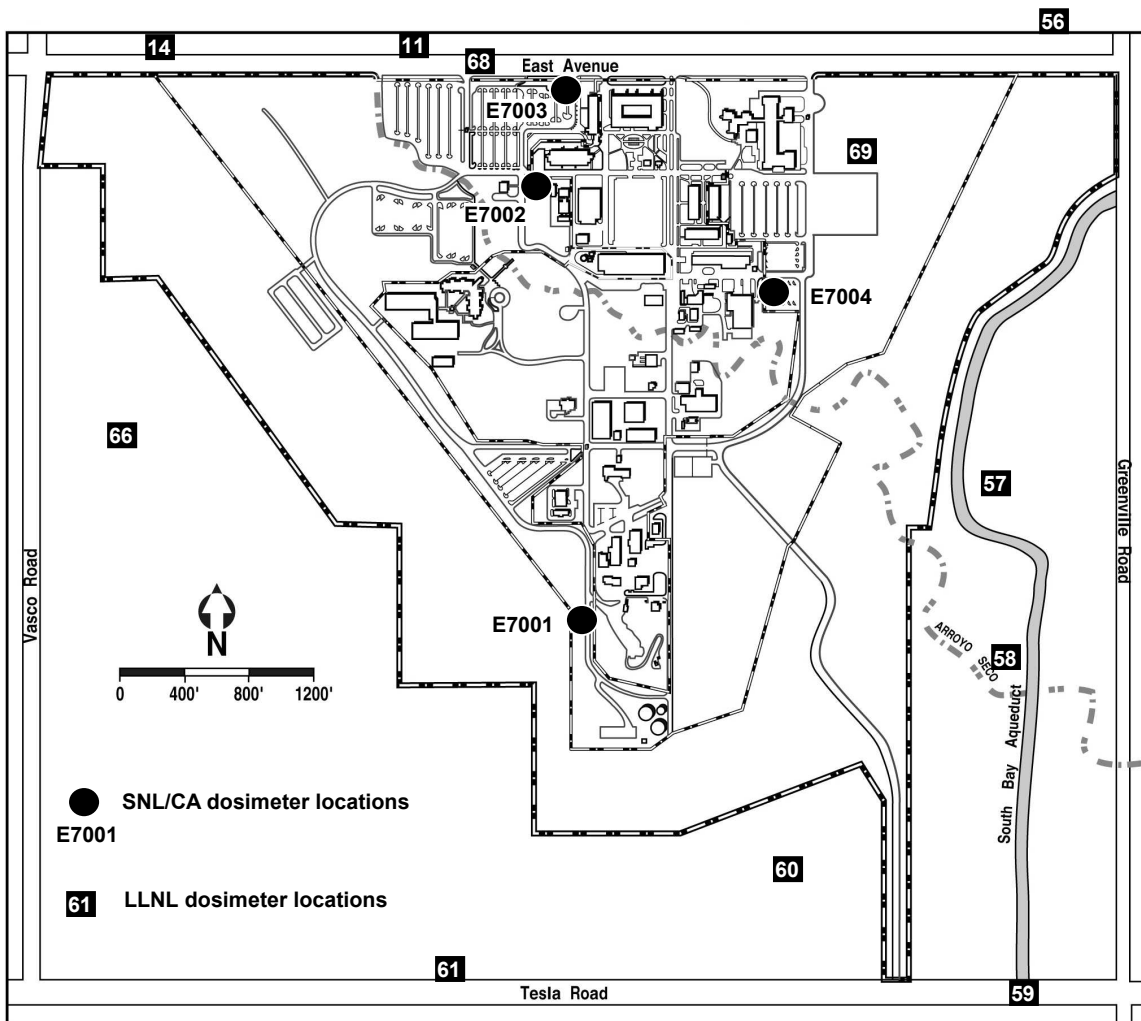


Figure 5-5 Dosimeter Locations at SNL/CA and Around Site Perimeter

In 2002, the average annual perimeter dose was 66.0 mrem (0.66 mSv). The average annual dose measurement for distant locations was 62.8 mrem (0.63 mSv). The 2002 data for both perimeter and distant locations are within the range measured over the last ten years. Since 1992, the annual average dose at the SNL/CA perimeter ranged from 56 mrem to 68 mrem. Over this same period, the average annual dose measured at distant locations ranged from 53.4 mrem to 73 mrem.

The difference between the perimeter and distant location measurements for 2002 is attributed to normal fluctuations and natural variations in ambient radiation. SNL/CA does not appear to be a significant contributor to external radiation dose in the surrounding environment.

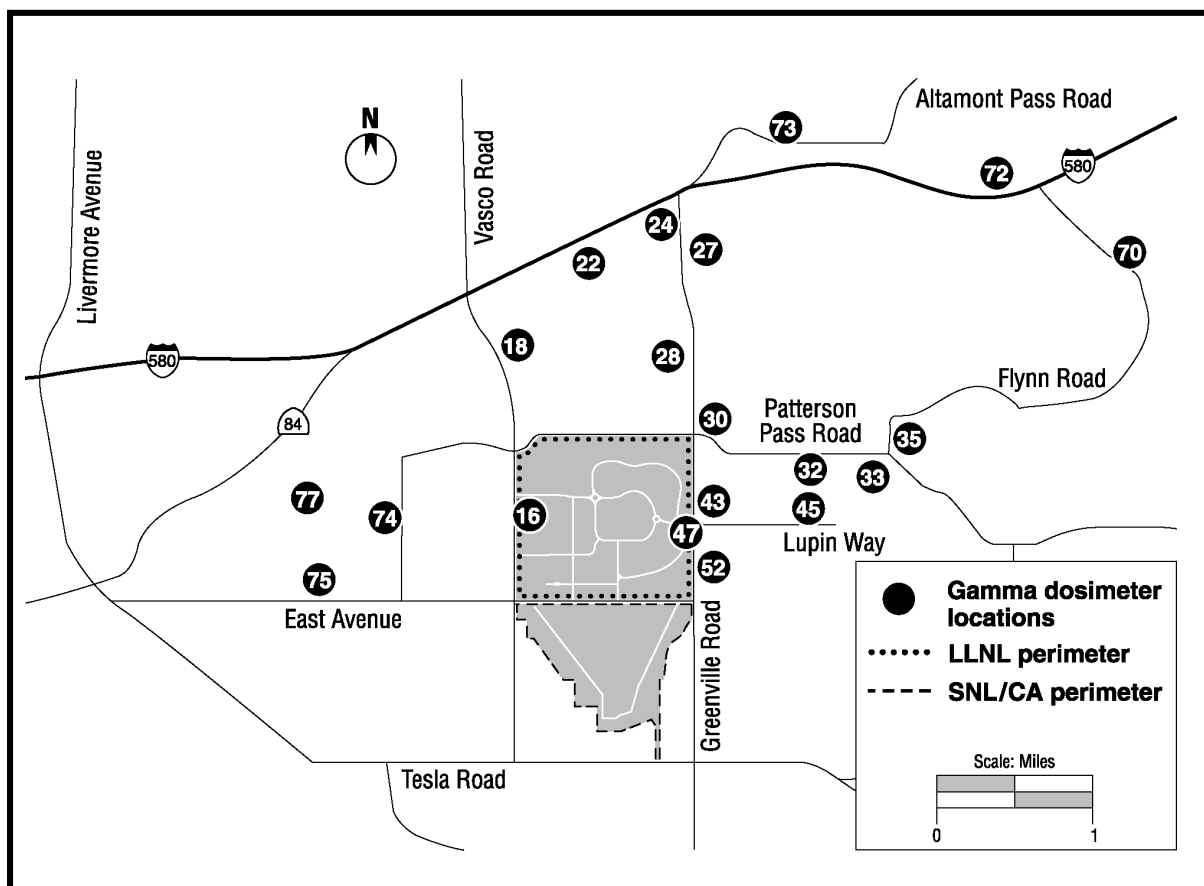


Figure 5-6 Dosimeter Locations in Livermore Valley

6 Quality Assurance

The Sandia Corporate Quality Assurance Program, defined in CPR001.3.2 (SNL 2002c), is implemented in California through the Sandia National Laboratories, California (SNL/CA) Quality Assurance Program (QAP) (SNL/CA 2002c) and the Quality Assurance Program Plan (QAPP) (SNL/CA 2002b). Compliance with the QAP and QAPP satisfy the requirements established in the Department of Energy (DOE) Nuclear Safety Management Regulations, Subpart A, Quality Assurance Requirements (10 CFR 830), and *DOE Order 414.1A, Quality Assurance* (DOE 1999). Quality assurance requirements are incorporated into all site operations, including the Environmental Monitoring, Restoration, and Surveillance Program.

DOE Order 414.1A identifies ten criteria that are integral to a quality program:

- QA plan
- Personnel training and qualification
- Quality improvement process
- Documents and records
- Established work processes
- Established standards for design and verification
- Established procurement requirements
- Inspection and acceptance testing
- Management assessment
- Independent assessment

6.1 Program Quality Assurance

The Environmental Monitoring and Surveillance Program ensures quality in its activities through implementation of quality assurance plans and procedures. A program-specific QAPP addresses each of the ten criteria listed above, and documents quality assurance activities performed for the program (SNL 1998). The *Environmental Monitoring Plan* provides a detailed description of the monitoring and surveillance activities conducted at SNL/CA (SNL 2002b). Additional program operating procedures specify training requirements, establish work processes, define data verification and validation processes, and identify reporting and records management requirements. The operating procedures are reviewed by subject matter experts and approved by the Environmental Operations Department Manager.

6.2 Environmental Sampling

The protocol for environmental sampling at SNL/CA is contained in activity specific operating procedures. Elements of the protocol include appropriate sampling methods and equipment; sampling frequency; sampling locations; and sample handling, storage, and packaging. Implementation of the established protocol ensures that samples are representative of the environmental medium monitored and that monitoring requirements outlined in permits, DOE orders, and regulations are met. Chain-of-custody protocols are also used to ensure quality control through proper transfer of samples from the point of collection to the analytical laboratory.

6.3 Samples Analyses

Analyses of samples collected at SNL/CA are performed using one of three avenues, depending on the sample medium or constituent analyzed. The three avenues are: a State accredited laboratory; the SNL/CA Health Protection Laboratory; or the Sandia National Laboratories, New Mexico (SNL/NM) Health Instrumentation Laboratory.

6.3.1 Accredited Laboratory

A State of California accredited laboratory performs analyses of non-radiological samples collected at SNL/CA. To receive accreditation, a laboratory must implement a quality assurance plan. These laboratories are periodically inspected by the California Environmental Protection Agency to ensure that they are operating within regulatory and quality assurance requirements. Consistent with industry standards, non-radiological samples are processed according to Federal Environmental Protection Agency methods.

6.3.2 SNL/CA Health Physics Laboratory

Tritium analyses of storm water and sewer effluent are performed by the SNL/CA Health Protection Department in an onsite laboratory. These samples are analyzed by liquid scintillation counting, a standard technique for tritium analysis. The Health Physics Laboratory follows the guidance in the Sandia National Laboratories (SNL) Radiation Protection and Laboratory Services Quality Plan (SNL 2002e), and meets the Sandia and DOE quality criteria.

6.3.3 SNL/NM Health Instrumentation Laboratory

Thermoluminescent dosimeters used to collect external radiation measurements are processed by the Health Instrumentation Department at SNL/NM following established protocols and quality assurance/quality control requirements under the SNL Radiation Protection and Laboratory Services Quality Plan (SNL 2002e). Automated equipment is used to process the samples and analyze the resulting data.

6.4 Data Verification and Validation

SNL/CA conducts data verification and validation to ensure that environmental data is precise, accurate, representative, comparable, and complete. Verification and validation is accomplished through analyses of quality control samples and by conducting statistical analyses.

6.4.1 Quality Control Samples

Types of quality control samples prepared for the Environmental Monitoring, Restoration, and Surveillance Program include duplicate, spiked, and blank samples. A definition of each sample type follows.

- *Duplicate samples* are collected at the same time and location, and follow the same method, as a routine sample. These samples are used to assess the precision of sample collection and analytical processes.
- *Spiked samples* resemble a routine sample, but contain a known amount of one or more of the constituents of interest. These samples are obtained from an independent laboratory that certifies the concentration of the constituents.
- *Blank samples* resemble a routine sample matrix (e.g. deionized water is used for blank water samples), but lack the constituents of interest. These samples are used to assess background levels of constituents, and possible contamination of the samples in the laboratory or in the field.

SNL/CA's goal for number of quality control samples is 20 percent of the total sample load, where feasible. This includes quality control samples initiated at the laboratory. In 2002, SNL/CA collected twelve wastewater quality control samples, representing 23 percent of the sample load. No storm water or groundwater quality control samples were collected during 2002. As a result, a nonconformance report was issued and corrective actions implemented.

6.4.2 Statistical Analyses

Statistical analyses are used to determine completeness, precision, and accuracy of monitoring and surveillance data. Prior to performing statistical analyses, the data is normalized to ensure that valid results are obtained. Descriptions of the statistical tests follow.

- Completeness is evaluated by determining the ratio between the number of samples collected and the number of samples scheduled for collection. The data quality objective for completeness is 85 percent.
- Precision is evaluated using three methods: determining the ratio between routine and duplicate samples; tests of significant difference; and calculating the 95 percent confidence interval. Data quality objectives vary for precision depending on the results of laboratory analyses.

- Accuracy is also evaluated using three methods: determining the ratio between sample results and known values of spiked samples; tests of significant difference; and calculating the 95 percent confidence interval. Data quality objectives vary for accuracy depending on the results of laboratory analyses.

Table 6.1 summarizes the results of statistical analyses conducted in 2002. The results show that only one statistical test did not pass. This test, a precision test, was the average ratio between the routine and duplicate samples for total suspended solids. Test results are attributed to the highly heterogeneous nature of the sanitary sewer sample.

Table 6-1 Summary of Statistical Analyses, 2002

Sample Medium	Completeness Test	Precision Test		Accuracy Test	
	Results	# of Tests	Results	# of Tests	Results
Wastewater (sanitary sewer)	100%	14	13 of 14 passed	1	Passed
Storm water ^b	55% ^a	--	--	--	--
Groundwater ^b	100%	--	--	--	--

^a The low percentage of samples collected was reflective of the lack of rainfall at times samples could be collected, not a failure of the sampling system. A nonconformance report was not required.

^b It was not possible to run precision and accuracy tests on storm water or groundwater samples because quality control samples were not collected.

7 References

- 22 California Code of Regulations (CCR), Division 4.5, Environmental Health Standard for Management of Hazardous Waste.
- 10 Code of Federal Regulations (CFR) Part 830, Department of Energy, Nuclear Safety Management, Subpart A, Quality Assurance Requirements, Federal Register Vol. 66, Number 7, January 10, 2001.
- 10 CFR Part 1021, Department of Energy, National Environmental Policy Act Implementing Procedures, January 1997.
- 40 CFR Part 61, National Emissions Standards for Hazardous Air Pollutants, Subpart H – National Emissions Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities, December 1989.
- 40 CFR Part 262.41, Environmental Protection Agency, Standards Applicable to Generators of Hazardous Waste, Subpart D, Record-keeping and Reporting, July 1, 2001.
- 40 CFR Part 403, Environmental Protection Agency, General Pretreatment Regulations for Existing and New Sources of Pollution.
- 40 CFR Part 433, Environmental Protection Agency, Metal Finishing Point Source Category.
- 7 United States Code (USC) §136, Federal Insecticide, Fungicide, and Rodenticide Act, 1972.
- 15 USC §2601 et. seq., Toxic Substances Control Act of 1976.
- 16 USC § 470, National Historic Preservation Act of 1966.
- 16 USC § 703 et. seq., Migratory Bird Treaty Act of 1918.
- 16 USC §1531 et. seq., Endangered Species Act of 1973.
- 33 USC §1251, Clean Water Act of 1977.
- 42 USC § 2011 et. seq., Atomic Energy Act of 1954.
- 42 USC § 6901 et. seq., Resource Conservation and Recovery Act of 1976.
- 42 USC § 6961, Federal Facility Compliance Act of 1992.
- 42 USC § 7401, Clean Air Act Amendments of 1990.

42 USC § 9601, Comprehensive Environmental Response, Compensation, and Liability Act of 1980.

42 USC §11001 et. seq., Superfund Amendments and Reauthorization Act of 1986, Emergency Planning and Community Right-to-Know Act.

42 USC §13101 et. seq., Pollution Prevention Act of 1990.

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DOE 2003b, Site Wide Environmental Assessment for SNL/CA, Finding of No Significant Impact, March 20, 2003.

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EO 11990, Protection of Wetlands, Federal Register, Vol. 42, pp. 26961, May 25, 1977.

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8 Glossary

Ambient air	The surrounding atmosphere, usually the outside air, as it exists around people, plants, and structures. It does not include the air next to emission sources.
Biochemical oxygen demand	A measure of the amount of dissolved oxygen that microorganisms need to break down organic matter in water. Used as an indicator of water quality.
Categorical process	An industrial process that discharges wastewater and is regulated under 40 CFR, Part 403.
Chemical oxygen demand	The amount of oxygen required to degrade the organic compounds of wastewater. Used to measure the overall level of organic contamination in wastewater.
Dose	A term denoting the quantity of radiation energy absorbed.
Dosimeter	A portable detection device for measuring the total accumulated exposure to ionizing radiation.
Effluent	A liquid or gaseous waste discharged to the environment.
Emission	A gaseous or liquid stream containing one or more contaminants.
Ephemeral stream	A stream that flows only for a short duration during and following rainfall.
External radiation	Radiation originating from a source outside the body.
Fluvial sediments	A sedimentary deposit consisting of material transported by, suspended in, or laid down by a river or stream.
Lacustrine sediments	Sediments formed in, or relating to, a lake.
Mixed waste	Waste that contains both radioactive and hazardous constituents.
pH	A measure of hydrogen ion concentration in an aqueous solution. Acidic solutions have a pH less than 7, basic solutions have a pH greater than 7, and neutral solutions have a pH of 7.

Riparian	Pertaining to, situated in, or adapted to living on the banks of rivers and streams.
Specific conductivity	Measure of the ability of a material to conduct electricity.
Strike-slip fault	A fault with horizontal movement along the break where slipping is parallel with the strike of the fault.
Thermoluminescent dosimeter	A type of dosimeter. After being exposed to radiation, the material in the dosimeter (lithium fluoride) luminesces upon being heated. The amount of light the material emits is proportional to the amount of radiation (dose) to which it was exposed.
Total dissolved solids	Solids in water that pass through a filter. A measure of the amount of the amount of material dissolved in water.
Total suspended solids	Solids in water that can be trapped in a filter. Solids can include silt, decaying plant and animal matter, industrial wastes, and sewage.
Transverse fault	A fault that strikes obliquely or perpendicular to the general structural trend of the region.

9 Appendix of Groundwater Analytical Results

Table 9-1 Results of Groundwater Analyses at SNL/CA, 2002

	Date	Dichlorodifluoromethane µg/L	Chloromethane µg/L	Vinyl Chloride µg/L	Bromomethane µg/L	Chloroethane µg/L	Trichlorofluoromethane µg/L	1,1-Dichloroethene µg/L	Methylene Chloride µg/L	Trans-1,2-Dichloroethene µg/L	1,1 Dichloroethane µg/L	Cis-1,2-Dichloroethene µg/L	Trichloromethane (chloroform) µg/L	1,1,1-Trichloroethane µg/L	Carbon Tetrachloride µg/L	1,2 Dichloroethane µg/L	Trichloroethene µg/L	1,2-Dichloropropane µg/L
Detection limit		2.0	0.5	1.0	1.0	0.5	0.5	0.5	2.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
MCL - California				0.5			150	6		10	5	6		200	0.5	0.5	5	5
MCL - Federal				2				7	5	100		70	100	200	5	5	5	5
Well ID																		
NLF-6	3/27/02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.1	ND	ND	ND
	6/17/02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	9/24/02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	11/13/02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.56	ND	0.94	ND	ND	ND
MW-406	6/17/02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AS-3A	6/18/02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AS-3B	6/18/02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AS-3C	6/18/02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FM-1	2/26/02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6/17/02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
FM-7	2/26/02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6/17/02 ^a	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AS-4	6/18/02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

^a FM-7 well was dry on 6/17/02 and a sample could not be collected.

^b Secondary drinking water standard.

MCL – Maximum contaminant level.

ND – Non-detectable.

-- Not required to analyze or sample not collected.

Table 9-1 Results of Groundwater Analyses at SNL/CA, 2002 (continued)

Date		Bromodichloromethane µg/L	Cis-1,3-Dichloropropene µg/L	Trans-1,3-Dichloropropene µg/L	1,1,2-Trichloroethane µg/L	Tetrachloroethene µg/L	Dibromochloromethane µg/L	Chlorobenzene µg/L	Bromoform µg/L	1,1,2,2-Tetrachloroethane µg/L	1,3-Dichlorobenzene µg/L	1,4-Dichlorobenzene µg/L	1,2-Dichlorobenzene µg/L	Benzene µg/L	Toluene µg/L	Ethylbenzene µg/L	Xylenes µg/L	8015-Extractables µg/L	8015-Diesel (w/silica gel clean-up) µg/L
Detection limit		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	50	50
MCL - California			05		32	5		30		1		5		1			1750		
MCL - Federal		100			5	5	100	100	100		600	75	600	5	1000	700	10000		
Well ID																			
NLF-6	3/27/02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	--	--	--	--
	6/17/02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	--	--	--	--
	9/24/02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	--	--	--	--
	11/13/02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	--	--	--	--
MW-406	6/17/02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	ND
AS-3A	6/18/02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	--	--	--	ND
AS-3B	6/18/02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	--	--	--	ND
AS-3C	6/18/02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	--	--	--	87
FM-1	2/26/02	--	--	--	--	--	--	ND	--	--	ND	ND	ND	ND	ND	ND	ND	--	340
	6/17/02	--	--	--	--	--	--	--	--	--	--	--	--	ND	ND	ND	ND	--	8000
FM-7	2/26/02	--	--	--	--	--	--	ND	--	--	ND	ND	ND	ND	ND	ND	ND	--	310
	6/17/02 ^a	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AS-4	6/18/02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	--	--	--	ND

^a FM-7 well was dry on 6/17/02 and a sample could not be collected.

^b Secondary drinking water standard.

MCL – Maximum contaminant level.

ND – Non-detectable.

-- Not required to analyze or sample not collected.

Table 9-1 Results of Groundwater Analyses at SNL/CA, 2002 (continued)

	Date	pH (standard units)	Conductance umhos/cm	Antimony mg/L	Arsenic mg/L	Barium mg/L	Beryllium mg/L	Cadmium mg/L	Chromium mg/L	Cobalt mg/L	Copper mg/L	Lead mg/L	Mercury mg/L	Molybdenum mg/L	Nickel mg/L	Selenium mg/L	Silver mg/L	Thallium mg/L	Vanadium mg/L
Detection limit		None	1	0.006	0.002	0.005	0.004	0.005	0.05	0.05	0.005	0.005	0.002	0.01	0.01	0.05	0.01	0.002	0.01
MCL - California					0.05	1		0.01	0.05		1 ^b	0.05	0.002			0.01	0.05		
MCL - Federal			900 ^b	0.006		2	0.004	0.005	0.1		1 ^b		0.002		0.1	0.05	0.1 ^b	0.002	
Well ID																			
NLF-6	3/27/02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6/17/02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	9/24/02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	11/13/02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-406	6/17/02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AS-3A	6/18/02	--	--	ND	ND	0.1	ND	ND	ND	ND	ND	ND	ND	ND	0.2	ND	ND	ND	ND
AS-3B	6/18/02	--	--	ND	ND	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AS-3C	6/18/02	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FM-1	2/26/02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6/17/02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
FM-7	2/26/02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6/17/02 ^a	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AS-4	6/18/02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

^a FM-7 well was dry on 6/17/02 and a sample could not be collected.

^b Secondary drinking water standard.

MCL – Maximum contaminant level.

ND – Non-detectable.

-- Not required to analyze or sample not collected.

Table 9-1 Results of Groundwater Analyses at SNL/CA, 2002 (continued)

	Date	Zinc mg/L	Aluminum mg/L	Surfactants (MBAS) mg/L	Chloride mg/L	Nitrate (as Nitrogen) mg/L	Nitrate (as NO3) mg/L	Sulfate mg/L	Hydroxide Alkalinity mg/L	Carbonate mg/L	Bicarbonate mg/L	Iron mg/L	Total dissolved solids mg/L	Calcium mg/L	Potassium mg/L	Magnesium mg/L	Manganese mg/L	Sodium mg/L	Hardness mg/L	Tritium pCi/L
Detection limit		0.05	0.05	0.05	10	0.3	10	20	1	1	1	0.05	5	0.1	2	0.1	0.01	1.0	1	675
MCL - California		5 ^b	1	0.5 ^b	500 ^b		45	500 ^b				0.3 ^b	1,000 ^b			0.05 ^b	0.05 ^b			20000
MCL - Federal		5 ^b	0.2 ^b	0.5 ^b	250 ^b	10		250 ^b				0.3 ^b	500 ^b			0.05 ^b	0.05 ^b			
Well ID																				
NLF-6	3/27/02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6/17/02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	9/24/02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	11/13/02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-406	6/17/02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AS-3A	6/18/02	ND	0.2	--	--	--	--	--	--	--	--	0.2	--	73	ND	--	ND	76	--	--
AS-3B	6/18/02	ND	0.1	--	--	--	--	--	--	--	--	0.1	--	ND	ND	--	ND	83	--	--
AS-3C	6/18/02	ND	ND	--	--	--	--	--	--	--	--	ND	--	26	ND	--	ND	48	--	--
FM-1	2/26/02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6/17/02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
FM-7	2/26/02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6/17/02 ^a	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AS-4	6/18/02	ND	0.2	--	--	--	--	--	--	--	--	0.2	--	140	ND	--	ND	210	--	--

^a FM-7 well was dry on 6/17/02 and a sample could not be collected.

^b Secondary drinking water standard.

MCL – Maximum contaminant level.

ND – Non-detectable.

-- Not required to analyze or sample not collected.

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